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VEN

Practical Carpentry

BEING A COMPLETE, UP-TO-DATE EXPLANATION OF MODERN CARPENTRY AND AN ENCYCLOPEDIA ON THE MODERN METHODS
USED IN THE ERECTION OF BUILDINGS, FROM THE
LAYING OF THE FOUNDATION TO THE
DELIVERY OF THE BUILDING
TO THE PAINTER

IN TWO VOLUMES

EDITED UNDER THE SUPERVISION OF

WILLIAM A. RADFORD

EDITOR-IN-CHIEF OF THE "AMERICAN CARPENTER AND BUILDER," PRESIDENT OF
"THE RADFORD ARCHITECTURAL CO.," AUTHOR OF "THE STEEL SQUARE
AND ITS USES" AND THE BEST AUTHORITY IN THE COUNTRY ON
ALL THINGS PERTAINING TO THE BUILDING TRADE

ASSISTED BY

ALFRED W. WOODS AND WILLIAM REUTHER

VOLUME I.

INDUSTRIAL PUBLICATION CO.
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Chicago Ill.

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PREFACE

In getting out the present work it has been my constant aim to take up the subject of building construction in a systematic and concise way. With this object in view, I have first treated the subject of geometry in so far as it proved a help in carpentry. Every example given involves some fundamental principle of carpentry and if thoroughly mastered will prove of inestimable value later on in the work.

One chapter is devoted to the use of the steel square in carpentry in which a number of suggestions are given, especially along the line of roof framing which will help to simplify what was formerly a troublesome part of carpenter work. In treating the subject of house framing, both good and faulty methods of construction are given so as to more clearly bring out the errors most common in the trade. Various ways of constructing cornice, sills and porches are illustrated. Framing studding and joist bearer and cutting window openings are also described in a comprehensive manner.

In the chapter of roof construction it has been thought best to start with the simplest shed roof and work into the more complicated roofs, covering in the chapter all the principles involved in their construction.

The department of questions and answers is one of the most useful, interesting and instructive parts of this work. They are questions which have arisen in the daily work of practical carpenters all over the country and in answering them my aim has been to make them as clear and concise as possible so as to be understood by everyone.

Original illustrative diagrams, over two hundred in number, are contained in the work, including many full-page illustrations which give clearer and better ideas than could be given in any other way.

Great care has been taken to secure absolute accuracy in all of this work so as to make it reliable in every detail.

All the rules and examples are placed under appropriate headings, with index commencement words printed in bold type, so that the eye of the reader can catch the particular information wanted at a glance.

We are fortunate in being able to present a number of full-page details, showing the construction of cornices, porches, stairs, etc., which were prepared for this work by G. W. Ashby.

It has not been thought necessary to give any explanation of these details, as they are self-explanatory. They show the construction of each part completely and complete dimensions are given in all cases.

In Volume II the subject is taken up where it was left off in this volume, treating the subject of stair building, shingling, window construction, fireplace construction and the various kinds of mouldings.

William A. Radford,
Chicago, Ill.

Practical Carpentry

Part I

GEOMETRY. Magnitude—Solid—Surface—Plane—Angle—Quantity of an angle — Right angle — Acute angle — Obtuse angle — Parallelogram — Rectangle — Diagonal — Polygon — Circle — Radius of a circle — Chord of an arc — Tangent — Altitude — Inscribed polygon — Problems in Geometry — To bisect a given angle — To erect a perpendicular — To bisect a given straight line—To describe a square equal to two given squares — Inscribing a pentagon in a circle — To describe the circumference of a circle through three given points, Etc.

While it is not essential for a man to have a thorough knowledge of geometry in order to be a good carpenter, yet none will deny that with a knowledge of the science they would be more competent workmen and have a larger field to work in.

With this object in view we have thought it best to enter into some of the details of geometry and explain some of the more simple terms and problems, with the hope that it will give the student a desire for a more thorough knowledge of the subject.

The terms and definitions used in geometry are as follows:—

Geometry is the science of magnitude.

Magnitude has three dimensions: length, breadth and thickness.

A **Point** has position but not magnitude. Practically, it is represented by the smallest visible mark or dot; but geometrically understood, it occupies no space. The extremities or ends of lines are points; and when two or more lines cross one another, the places that mark their intersection are also points.

A **Line** has length, without breadth or thickness, and, consequently, a true geometrical line cannot be exhibited; for however fine a line may be drawn it will always occupy a certain extent of space.

A **Surface** has length and breadth, but no thickness. For instance, a shadow gives a very good representation of a surface—its length and breadth can be measured; but it has no depth or substance. The quantity of space contained in any plane surface is called its area.

A **Plane** is a flat surface, which will coincide with a straight line in every direction.

A **Curved or uneven surface** is one that will not coincide with a straight line in all directions. By the term surface is generally understood the outside of any body or object.

A **Solid** is anything which has length, breadth, and thickness; consequently the term may be applied to any visible object containing substance, but practically it is understood to signify the solid contents or measurements contained within the different surfaces of which any body is formed.

Lines may be drawn in any direction, and are termed straight, curved, mixed, concave or convex lines, according as they correspond to the following definitions:—

A **Straight Line** is one every part of which lies in the same direction between its extremities, and is, of course, the shortest distance between two points.

A **Curved Line** is such that it does not lie in a straight direction between its extremities, but is continually changing by inflection. It may be either regular or irregular.

A **Mixed Line** is composed of straight and curved lines, connected in any form.

A **Concave or Convex Line** is such that it cannot be cut by a straight line in more than two points; the concave or hollow side is turned towards the straight line, while the convex or swelling side looks away from it. For instance, the inside of a basin is concave; the outside of a ball is convex.

Parallel Straight Lines have no inclination, but are everywhere at an equal distance from each other; consequently they can never meet, though produced or continued to infinity in either or both directions.

Oblique or Converging Lines are straight lines which, if continued, being in the same plane, change their distance so as to meet or intersect each other.

An Angle is formed by the inclination of two lines meeting in a point; the lines thus forming the angle are called the sides, and the point where the lines meet is called the vertex or angular point.

When an angle is expressed by three letters, as A B C, Fig. 1, the middle letter B should always denote the angular point.

The Quantity of an Angle is estimated by the arc of any circle contained between the two sides or lines forming the angle; the junction of the two lines, or vertex of the angle, being the center from which the arc is described. As the circumferences of all circles are proportional to their diameters, the arcs of similar sectors also bear the same proportion to their respective circumferences; and, consequently, are proportional to their diameters and, of course, also their radii or semi-diameters. Hence, the proportion which the arc of any circle bears to the circumference of that circle determines the magnitude of the angle. From this it is evident that the quantity or magnitude of the angles does not depend upon the length of the sides or radii forming them, but wholly upon the number of degrees contained in the arc cut from the circumference of the circle

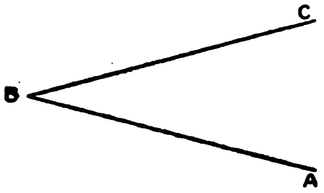


FIG. 1.

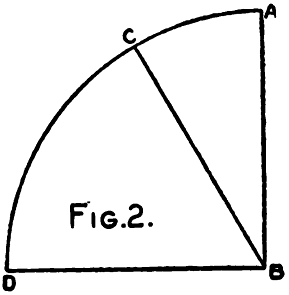


FIG. 2.

by the opening of these lines. The circumference of every circle is divided by mathematicians into 360 equal parts, called degrees; each degree being again subdivided into 60 equal parts, called minutes, and each minute into 60 equal parts called seconds. Hence, it follows that the arc of a quarter circle or quadrant includes 90 degrees; that is, one-fourth part of 360 degrees.

A **Right Angle** is produced by one straight line standing upon another so as to make the adjacent angles equal, and is an angle of 90 degrees. This is what workmen call "square," and is the most useful figure they employ.

An **Acute Angle** is less than a right angle, or less than 90 degrees.

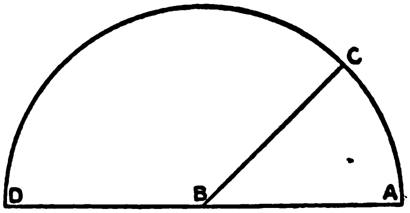


FIG. 3.

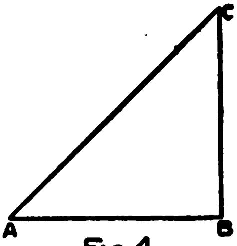


FIG. 4.

An **Obtuse Angle** is greater than a right angle, or more than 90 degrees.

The number of degrees by which an angle is less than 90 degrees is called the complement of the angle. For example, in Fig. 2, angle C B D is the complement of the angle A B D because angle A B C, plus angle C B D, is equal to a right angle or one of 90 degrees, or angle A B D.

The **difference between an obtuse angle and a semi-circle,** or 180 degrees, is called the supplement of that angle. For example, in Fig. 3, angle C D B is the supplement of the angle A D B because angle C D B, added to angle A C B, is equal to a semi-circle or an angle of 180 degrees.

Plane Figures are bounded by straight lines, and are named according to the number of sides which they contain. Thus, the space included within three straight lines, forming three angles, is called trilateral figure or triangle.

A **Right-angled Triangle** has one right angle: The sides forming the right angle are called the base and perpendicular; the side opposite the right angle is named hypothenuse. See Fig. 4, A B C is a right-angled triangle—A B is the base, C B is the perpendicular and A C is the hypothenuse. An isosceles triangle has only two sides equal; an equilateral triangle has all its sides of equal length. An acute-angled triangle has all its angles acute, and an obtuse-angled triangle has one of its angles only obtuse.

Quadrilateral Figures are literally four-sided figures; they are also called quadrangles, because they have four angles.

A **Parallelogram** is a figure whose opposite sides are parallel, as A B C D, in Fig. 5.

A **Rectangle** is a parallelogram having four right angles, as A B C D, in Fig. 5.

A **Square** is an equilateral rectangle, having all its sides and angles equal, like Fig. 5.

A **Diagonal** is a straight line drawn between two opposite angular points of a quadrilateral figure, or between any two angular points of a polygon. Should the figure be a parallelogram, the diagonal will divide it into two equal triangles, the opposite sides and angles of which will be equal to one another. Let A B C D, Fig. 6, be a parallelogram; join A C, then A C is a diagonal, and the triangles A D C and A B C, into which it divides the parallelogram, are equal.

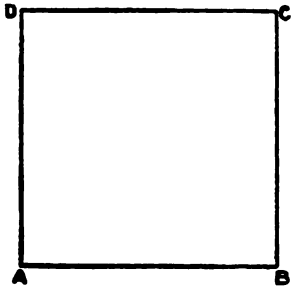


Fig. 5.

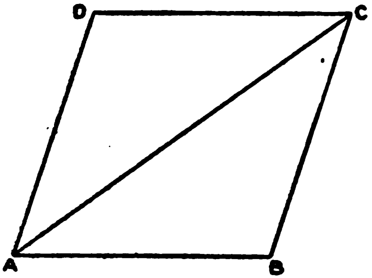


Fig. 6.

A **Polygon** is a portion of a plane terminated on all sides by straight lines. A regular polygon has all its sides and angles equal, and an irregular polygon has its sides and angles unequal.

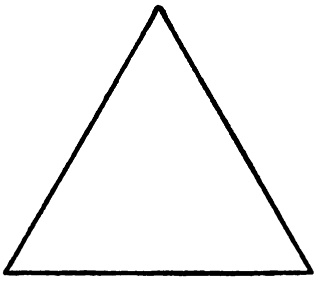


Fig. 7.

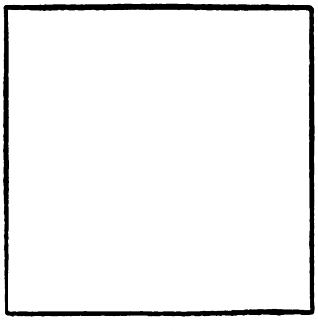


Fig. 8.

Polygons are named according to the number of their sides or angles, as follows:

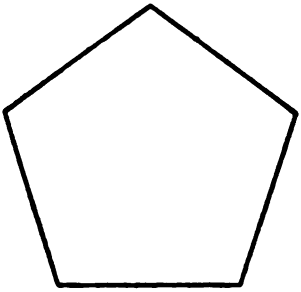


FIG. 9.

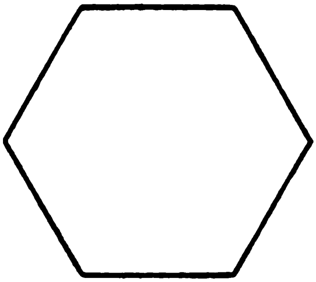


FIG. 10.

A Triangle is a polygon of three sides.	See Fig. 7.
A Square is a polygon of four sides.	See Fig. 8.
A Pentagon is a polygon of five sides.	See Fig. 9.
A Hexagon is a polygon of six sides.	See Fig. 10.
A Heptagon has seven sides.	See Fig. 11.
An Octagon has eight sides.	See Fig. 12.

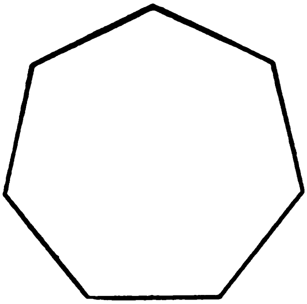


FIG. 11.

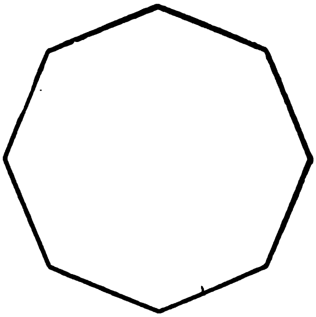


FIG. 12.

A Nonagon has nine sides.	See Fig. 13.
A Decagon has ten sides.	See Fig. 14.
An Undecagon has eleven sides.	See Fig. 15.
A Dodecagon has twelve sides.	See Fig. 16.

Figures having more than twelve sides are generally designated polygons, or many-angled figures.

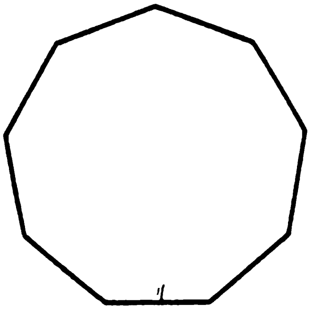


FIG. 13.

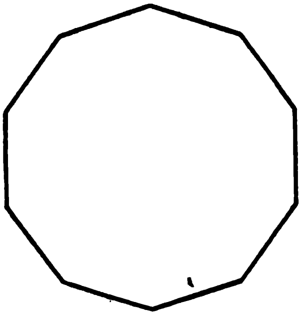


FIG. 14.

A **Circle** is a plane figure bounded by one uniformly curved line, called the circumference, every part of which is equally distant from a point within, called the center, as A in Fig. 17.

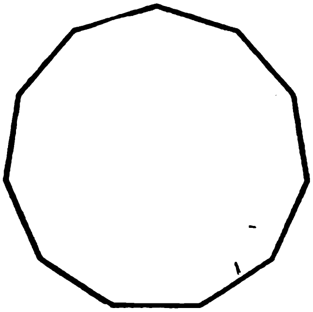


FIG. 15.

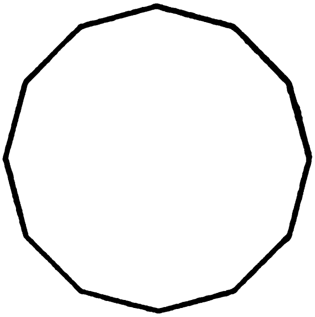


FIG. 16.

The **Radius of a Circle** is a straight line drawn from the center to the circumference; hence, all the radii of a circle are equal, as AB, AD, AC, AE, in Fig. 17.

The **Diameter of a Circle** is a straight line drawn through the center and terminated on each side by the circumference; consequently the circumference is exactly twice the length of the radius, and, therefore, the radius is sometimes called the semi-diameter. See B A C, Fig. 17.

The **Chord of an Arc** is any straight line drawn from one point in the circumference of a circle to another, joining the extremeties of the arc, and dividing the circle either into two equal or unequal parts. If into two equal parts, the chord is also the diameter, and the space included between the arc and the diameter, on either side of it, is called a semicircle. If the parts cut off by the chord are unequal, each of them is called a segment of a circle; but, unless otherwise stated, it is always understood that the smaller arc or segment is spoken of as in Fig. 18 A B is the chord of the arc A C B.

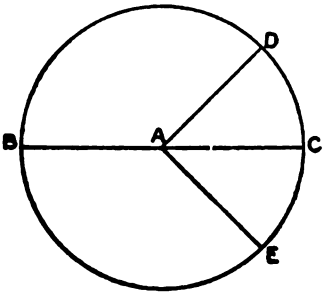


FIG. 17.

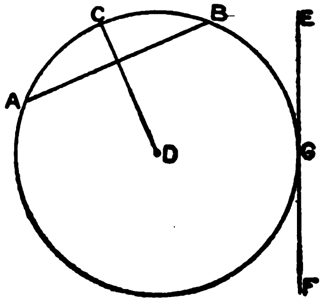


FIG. 18.

If a straight line be drawn from the center of a circle to meet the chord of an arc perpendicularly, as D C, in Fig. 18, it will divide the chord into two equal parts, and if the straight line be produced to meet the arc, it will also divide it into two equal parts, as A C, C B.

Each half of the chord is called the sine of the half arc to which it is opposite; and the line drawn from the center to meet the chord perpendicularly is called the co-sine of the half-arc. Consequently, the radius, the sine, the co-sine of an arc form a right angle.

A **Tangent** is any straight line which touches the circumference of a circle in one point, which is called the point of contact, as in the tangent E G F in Fig. 18.

An arc is any portion of the circumference of a circle, as A C B in Fig. 18.

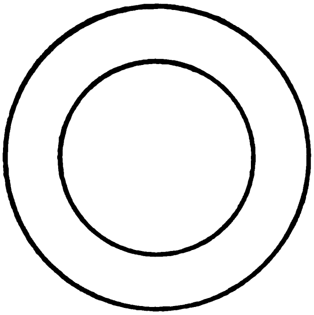


FIG. 19.

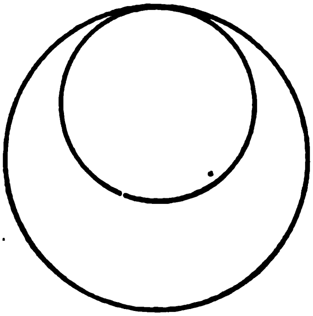


FIG. 20.

It may not be improper to remark here that the terms circle and circumference are frequently misapplied. Thus we say, describe a circle from a given point, instead of saying describe the circumference of a circle—the circumference being the curved line thus described, everywhere equally distant from a point within it, called the center; whereas the circle is properly the superficial space included within that circumference.

Concentric Circles are circles within circles, described from the same center; consequently their circumferences are parallel to one another, as in Fig. 19.

Eccentric Circles are those which are not described from the same center; eccentric circles may also be tangent circles; that is, such as come in contact in one point, only, as Fig. 20.

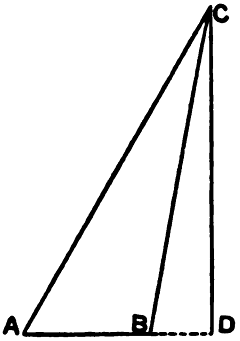


FIG. 21

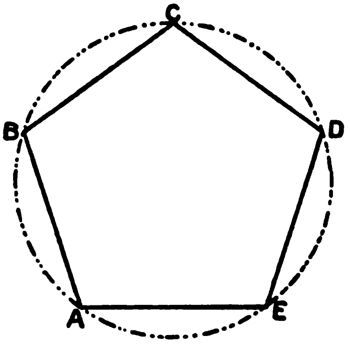


FIG. 22.

Altitude. The height of a triangle or other figure is called its altitude. To measure the altitude, let fall a straight line from the vertex or highest point in the figure, perpendicular to the base or opposite side; or, to the base continued, as at B D, Fig. 21, should the form of the figure require its extension. Thus C D is the altitude of the triangle A B C.

An **Inscribed Polygon** is one which, like A B C D E in Fig. 22, has all its angles in the circumference. The circle is then said to circumscribe such a figure.

We have now described all the figures we shall require for the purpose of thoroughly understanding all that will follow in this book; but we would like to say right here that the student who has time should not stop at this point in the study of geometry, for the time spent in obtaining a thorough knowledge of this useful science will bring in better returns than if expended for any other purpose.

Problems in Geometry.

We will now proceed to explain how the figures we have described can be constructed. There are several ways of constructing nearly every figure we produce; but we have chosen those methods

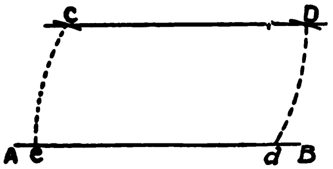


FIG. 23

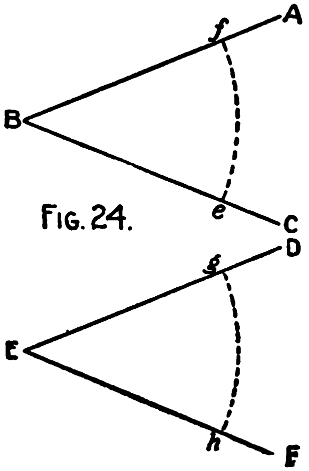


FIG. 24.

that seem to us the best, but to save space have given only those which are most essential in the study of practical carpentry.

Problem 1.—Through a given point C (Fig. 23), to **draw a straight line parallel to a given straight line** A B: In A B (Fig. 23) take any point d, and from d as a center with the radius dC, describe an arc Ce, cutting AB in e, and from C as a center, with the same radius, describe the arc dD, make dD equal to Ce, join C D, and it will be parallel to A B.

Problem 2.—To **make an angle equal to a given rectilineal angle:** From a given point E (Fig. 24), upon the straight line E F, to make an angle equal to the given angle A B C. From the angular point B, with any radius, describe the arc ef, cutting B C and B A in the points e and f. From the point E on E F, with the same radius, describe the arc hg, and make it equal to the arc ef; then from E, through g, draw the line E D: the angle D E F will be equal to the angle A B C.

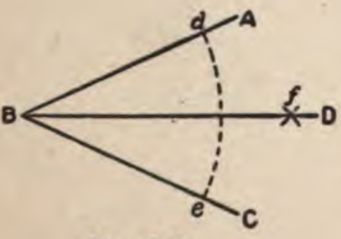


FIG. 25.

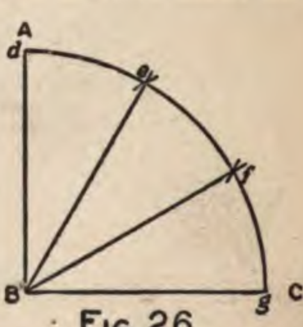


FIG. 26.

Probelm 3.—To **bisect a given angle:** Let A B C (Fig. 25) be the given angle. From the angular point B, with any radius, describe an arc cutting B A and B C in the points d and e; also, from the points d and e as centers, with any radius greater than half the distance between them, describe arcs cutting each other in f; through the points of intersection f, draw B f D: the angle A B C is bisected by the straight line B D; that is, it is divided into two equal angles, A B D and C B D.

Problem 4.—**To trisect or divide a right angle into three equal angles:** Let A B C (Fig. 26) be the given right angle. From the angular point B, with any radius, describe an arc cutting B A and

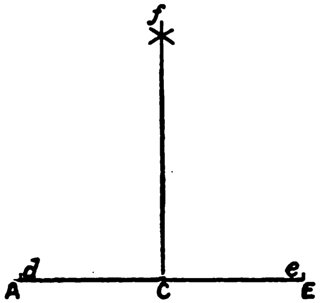


FIG. 27.

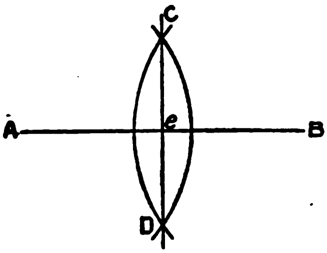


FIG. 28.

B C in the points d and g; from the points d and g, with the radius Bd or Bg, describe the arcs cutting the arc dg in e and f; join Be and Bf: these lines will trisect the angle A B C, or divide it into three equal angles.

Problem 5.—**From a given point C, in a given straight line A E, to erect a perpendicular:** From the point C (Fig. 27), with any radius less than

CA or CE, describe arcs cutting the given line A E in d and e; from these points as centers, with a radius greater than Cd or Ce, describe arcs intersecting each other in f: join Cf, and this line will be the perpendicular required.

Problem 6.—To **bisect a given straight line:** Let A B (Fig. 28) be the given straight line. From the extreme points A and B as centers, with any equal radii greater than half the length of AB, describe arcs cutting each other in C and D: a straight line drawn through the points of intersection C and D, will bisect the line AB in e.

Problem 7.—To **divide a given line into any number of equal parts:** Let AB (Fig. 29) be the given line to be divided into five equal parts.

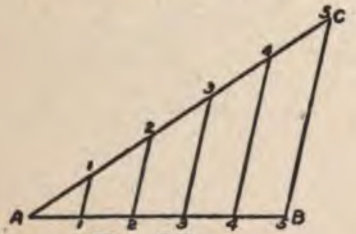


FIG. 29.

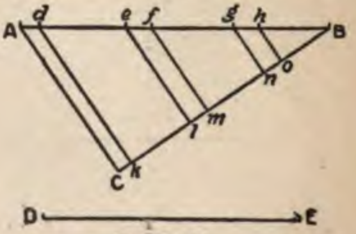


FIG. 30.

From the point A draw the straight line AC, forming any angle with AB. On the line AC, with any convenient opening of the compasses, set off five equal parts toward C; join the extreme points CB; through the remaining points 1, 2, 3 and 4, draw lines parallel to BC, cutting AB in the corresponding points 1, 2, 3 and 4: AB will be divided into five equal parts as required.

There are several other methods by which lines may be divided into equal parts; they are not necessary, however, for our purpose, so we will content ourselves with showing how this problem may be used for changing the scales of drawings whenever such change is desired. Let AB (Fig. 30) represent the length of one scale of drawing, divided into the given parts Ad, de, ef, fg, gh and hB; and DE the length of another scale or drawing required to be divided into similar parts. From the point B draw a line BC-DE, and forming any angle with AB; join AC, and through the points d, e, f, g and h, draw dk, el, fm, gn, ho, parallel to AC; and the parts Ck, kl, lm, etc., will be to each other, or to the whole line BC, as the lines Ad, de, ef, etc., are to each other, or to the given line or scale AB. By this method, as will be evident from the figure, similar divisions can be obtained in lines of any given length.

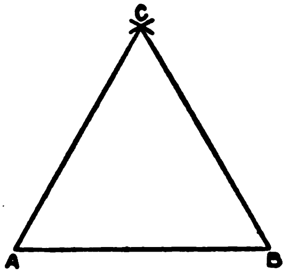


FIG. 31.

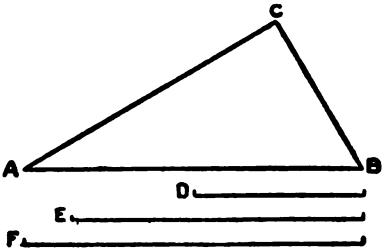


FIG. 32.

Problem 8.—**To describe an equilateral triangle upon a given straight line:** Let AB (Fig. 31) be the given straight line. From the points A and B, with a radius equal to AB, describe arcs intersecting each other in the point C. Join CA and CB, and ABC will be the equilateral triangle required.

Problem 9.—**To construct a triangle whose sides shall be equal to three given lines,** F, E, D: Draw AB (Fig. 32) equal to the given line F. From A as a center, with a radius equal to the line E, describe an arc; then from B as a center, with a radius equal to the line D, describe another arc intersecting the former in C; join CA and CB, and ABC will be the triangle required.

Problem 10.—**To describe a rectangle or parallelogram having one of its sides equal to a given line, and its area equal to that of a given rectangle:** Let AB (Fig. 33) be the given line, and CDEF the given rectangle. Produce CE to G, making EG equal to AB; from G draw GK parallel to EF, and meeting DF produce in H. Draw the diagonal GF, extending it to meet CD produced in L; also draw LK parallel to DH, and produce EF till it meets LK in M; then FMKH is the rectangle required.

Equal and similar parallelograms of any dimensions may be drawn after the same manner, seeing the complements of the parallelograms which are described on or about the diagonal of any parallelogram, are always equal to each other; while the parallelograms themselves are always similar to each other, and to the original parallelogram about the diagonal of which they are constructed. Thus, in the parallelogram CGKL the complements CEFD and FMHK are always equal, while the parallelograms EFHG and DFML about the diagonal GL, are always similar to each other, and to the whole parallelogram CGKL.

Problem 11.—**To describe a square equal to two given squares:** Let A and B (Fig. 34) be the given squares. Place them so that a side of each may form the right angle DCE; join DE, and upon this hypothenuse describe the square DEGF, and it will be equal to the sum of the squares A and B, which are constructed upon the legs of the right-angled triangle DCE. In the same manner, any other rectilineal figure, or even circle, may be found equal to the sum of other two similar figures or circles. Suppose the lines CD and CE to be the diameters of two circles, then DE will be the diameter of a third, equal in area to the other two circles. Or suppose CD and CE to be the

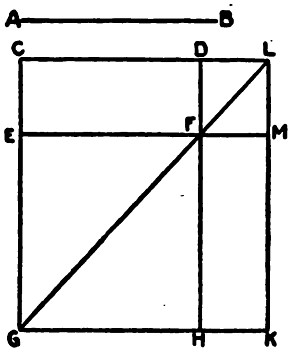


FIG. 33.

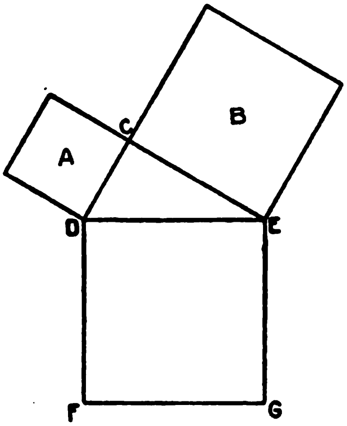


FIG. 34.

like sides of any two similar figures, then DE will be the corresponding side of another similar figure equal to both of the former.

Problem 12.—**To describe a square equal to any number of given squares:** Let it be required to construct a square equal to three given squares A, B and C (Fig. 35). Take the line DE, equal to the side of the square C. From the extremity D erect DF perpendicular to DE, and equal to the side of the square B: join EF; then a square described upon this line will be equal to the sum of the two given squares C and B. Again, upon the straight line EF erect the perpendicular FG, equal to the side of the third square A; and join GE, which will be the side of the square GEHK, equal in area to A, B and C. Proceed in the same manner for any given number of squares.

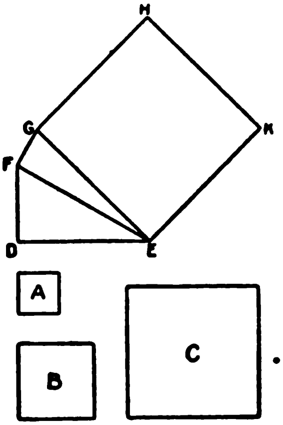


FIG. 35.

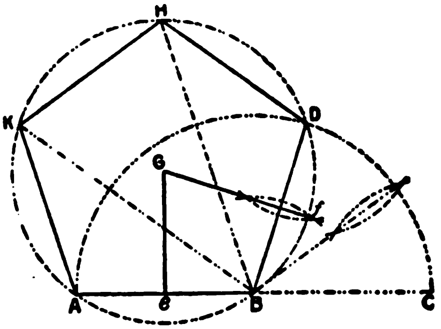


FIG. 36.

Problem 13.—**Upon a given straight line to describe a regular polygon:** To produce a regular pentagon draw AB to C (Fig. 36), so that BC may be equal to AB; from B as a center, with the radius BA or BC describe the semicircle ADC; divide the semi-circumference ADC into as many equal parts as there are parts in the required polygon, which, in the present case, will be five; through the second division from C draw the straight line ED, which will form another side of the figure. Bisect AB at e, and BD at f, and draw eG and fG perpendicular to AB and BD; then G, the point of intersection, is the center of a circle, of which AB and D are points in the circumference. From G, with a radius equal to its distance from any of these points, describe the circumference ABDHK; then producing the dotted lines from the center B, through the remaining divisions of the semicircle ADC, so as to meet the circumference of which G is the center, in H and K, these points will divide the circle ABDHK into the number of parts required, each part being equal to the given side of the pentagon.

From the preceding example it is evident that polygons of any number of sides may be constructed upon the same principles, because the circumference of all circles, when divided into the same number of parts, produce equal angles; and, consequently, by dividing the semi-circumference of any circle into the number of parts required, two of these parts will form an angle which will be subtended by its corresponding parts of the whole circumference. And as all regular polygons can be inscribed in a circle, it must necessarily follow, that if a circle be described through three given angles of the polygon, it will contain the number of sides or angles required.

The above is a general rule by which all regular polygons may be described upon a given straight line; but there other methods by which many of them may be more expeditiously constructed, as shown in the following examples:

Problem 14.—**Upon a given straight line to describe a regular pentagon:** Let AB (Fig. 37) be the given straight line; from its extremity B erect Bc perpendicular to AB, and equal to its half. Join Ac, and produce it till cd be equal to Bc, or half of the given line AB. From A and B as centers, with a radius equal to Bd, describe arcs intersecting each other in e, which will be the center of the circumscribing circle ABFGH. The side AB, applied successively to this circumference, will give the angular points of the penta-

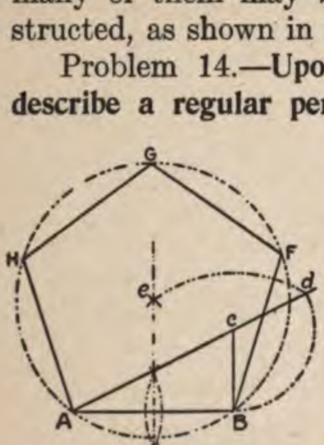


FIG. 37.

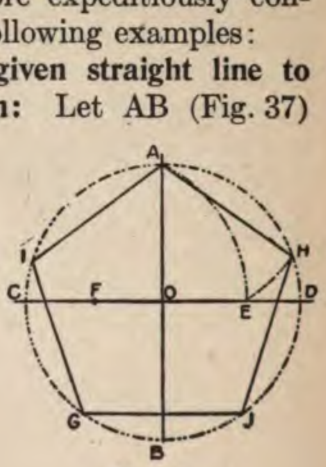


FIG. 38.

gon; and these being connected by straight lines will complete the figure.

Problem 15.—**Another method of inscribing a pentagon in a circle:** In Fig. 38, draw two diameters AB and CD, at right angles to each other, as at O. From O as center describe the desired circumference. Bisect the radius C O at F; with F as a center and FA as a radius, describe the arc cutting O D at E. With A as a center and AE as a radius, describe the arc HE cutting the circumference of the circle at H, with the same radius describe an arc cutting the circumference of the circle at I. With these points as centers and using the same radius AE describe arcs cutting the circumference of the circle at J and G. Join HAIG and J and we have the inscribed regular pentagon.

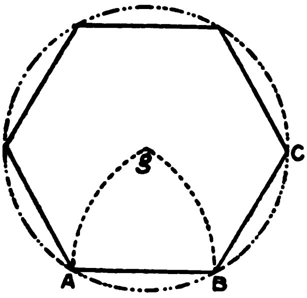


Fig. 39.

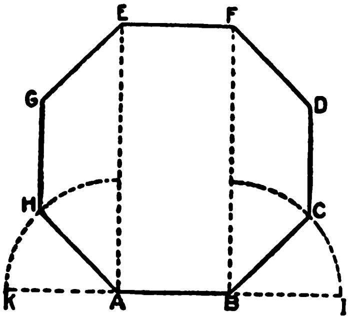


Fig. 40.

Problem 16.—**Upon a given straight line describe a regular hexagon:** Let AB (Fig. 39) be the given straight line. From the extremities A and B as centers, with the radius AB, describe arcs cutting each other in g. Again, from g, the point of intersection, with the same radius, describe the circle ABC, which will contain the given side AB six times when applied to its circumference, and will be the hexagon required.

Problem 17.—To **describe a regular octagon upon a given straight line:** Let AB (Fig. 40) be the given line. From the extremities A and B erect the perpendiculars AE and BF; extend the given line both ways to k and l, forming external right angles with the lines AE and BF. Bisect these external right angles, making each of the bisecting lines AH and BC equal to the given line AB. Draw HG and CD parallel to AE or BF, and each equal in length to AB. Draw from G, GE parallel to BC, and intersecting AE in E, and from D draw DF parallel to AH, intersecting BF in F. Join EF, and ABCDFEGH is the octagon required. Or from D and G as centers, with the given line AB as radius, describe arcs cutting the perpendiculars AE and BF in E and F, and join GE, EF, FD, to complete the octagon.

Otherwise, thus:—Let AB (Fig. 41) be the given straight line upon which the octagon is to be described. Bisect it in a, and draw the perpendicular ab equal to Aa or Ba. Join Ab, and produce ab to c, making bc equal to Ab; join also Ac to Bc, extending them so as to make cE and cF each equal to Ac or Bc. Through c draw Ccg, at right angles to AE. Again, through the same point c, draw DH at right angles to BF, making each of the lines cC, cD, cG, and cH equal to Ac and Bc, and, consequently, equal to each other. Lastly, join BC, CD, DE, EF, FG, GH, HA; ABCDEFGH will be the regular octagon described upon AB, as required.

Problem 18.—**In a given square to inscribe a given octagon:** Let ABCD (Fig. 42) be the given square. Draw the diagonals AC and BD, intersecting each other in e; then from the angular points ABC and D as centers, with a radius equal to half the diagonal, viz.: Ae or Ce, describe arcs cutting the sides of the square in the points f, g, h, k, l, m, n, o, and the straight lines of gh, kl, and mn, joining these points will complete the octagon, and be inscribed in the square ABCD, as required.

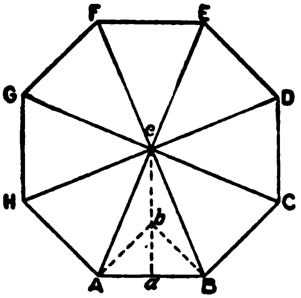


FIG. 41.

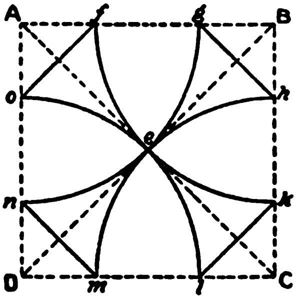


FIG. 42.

Problem 19.—**To find the area of any regular polygon:** Let the given figure be a hexagon; it is required to find its area. Bisect any two adjacent angles, as those at A and B (Fig. 43), by the straight lines AC and BC, intersecting in C, which will be the center of the polygon. Mark the altitude of this elementary triangle by the dotted line drawn from C perpendicular to the base AB; then multiply together the base and altitude thus found, and this product by the number of sides: one-half of the product gives the area of the whole figure.

Or otherwise thus: Draw the straight line DE, equal to six times; that is, as many times AB, the base of the elementary triangle, as there are sides in the given polygon. Upon DE describe an isosceles triangle, having the same altitude as ABC, the elementary triangle of the given polygon; the triangle thus constructed is equal in area to the given hexagon; consequently, by multiplying the base and the altitude of this triangle together half the product will be the area required. The rule may be expressed in other words as follows: The area of a regular polygon is equal to its perimeter, multiplied by half the radius of its inscribed circle, to which the sides of the polygon are tangents.

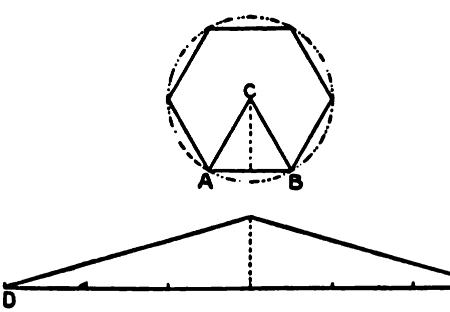


FIG. 43.

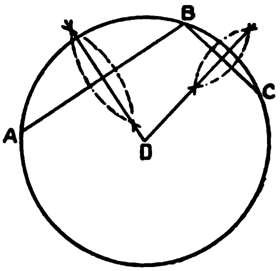


FIG. 44.

Problem 20.—**To describe the circumference of a circle through three given points:** Let A, B, C (Fig. 44) be the given points not in a straight line. Join AB and BC; bisect each of the straight lines AB and BC by perpendiculars meeting in D; then A, B and C are all equi-distant from D; therefore a circle described from D, with the radius DA, DB, or DC, will pass through all the three points, as required.

Problem 21.—**To divide a given circle into any number of equal or proportional parts by concentric divisions:** Let ABC (Fig. 45) be the given circle, to be divided into five equal parts. Draw the radius AD, and divide it into the same number of parts as those required in the circle; and upon the radius thus divided, describe a semicircle; then from each point of division on AD, erect perpendiculars to meet the semi-circumference in e, f, g and h. From D, the center of the given circle, with radii extending to each of the different points of intersection on the semicircle,

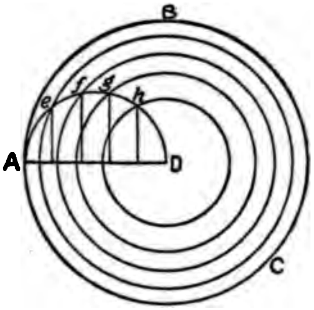


FIG. 45.

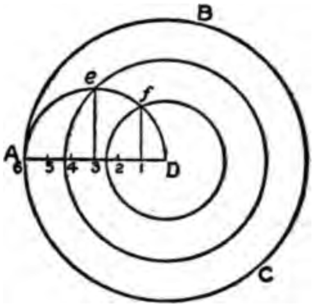


FIG. 46.

describe successive circles, and they will divide the given circle into five parts of equal area, as required; the center part being also a circle, while the other four will be in the form of rings.

Problem 22.—**To divide a circle into three concentric parts, bearing to each other the proportion of one, two, three, from the center:** Draw the radius AD (Fig. 46), and divide it into six equal parts. Upon the radius thus divided, describe a semicircle: from the first and third points of division, draw perpendiculars to meet the semicircumference in e and f. From D, the center of the given circle, with radii extending to e and f, describe circles which will divide the given circle into three parts, bearing to each other the same proportion as the divisions on AD, which are as 1, 2 and 3. In like manner circles may be divided in any given ratio by concentric divisions.

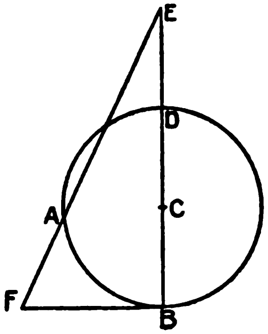


Fig 47.

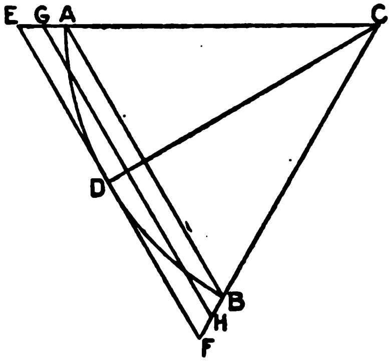


Fig. 48.

Problem 23.—**To draw a straight line equal to any given arc of a circle:** Let AB (Fig. 47) be the given arc. Find C the center of the arc, and complete the circle ADB. Draw the diameter BD, and produce it to E, until DE be equal to CD. Join AE, and extend it so as to meet a tangent drawn from B in the point F; then BF will be nearly equal to the arc AB.

The following method of finding the length of an arc is equally simple and practical, and not less accurate than the one just given: Let AB (Fig. 48) be the given arc. Find the center C, and join AB, BC and CA. Bisect the arc AB in D, and join also CD; then through the point D draw the straight line EDF, at right angles to CD, and meeting CA and CB produced in E and F. Again, bisect the lines AE and BF in the points G and H. A straight line GH, joining these points, will be a very near approach to the length of the arc AB.

Seeing that, in very small arcs, the ratio of the chord to the double tangent or, which is the same thing, that of a side of the inscribed to a side of the circumscribing polygon, approaches to a ratio of equality, an arc may be made so small, that its length shall differ from either of these sides by less than any assignable quantity; therefore, the arithmetical mean between the two must differ from the length of the arc itself by less than any that can be assigned. Consequently the smaller the given arc, the more nearly will the line found by the last method approximate to the exact length of the arc. If the given arc is above 60 degrees, or two-thirds of a quadrant, it ought to be bisected, and the length of the semi-arc thus found being double, will give the length of the whole arc.

These problems are very useful in obtaining the lengths of veneers or other materials required for bending round soffits of doors and window-heads.

Problem 24.—To **describe the segment of a circle by means of two laths, the chord and versed sine being given:** Take two rods, EB, BF (Fig. 49), each of which must be at least equal in length to the chord of the proposed segment AC; join them together at B, and expand them, so that their edges shall pass through the extremities of the chord, and the angle where they join shall be on the extremity B of the versed sine DB, or height of the segment. **Fix** the rods in that position by the cross piece gh, then by guiding the edges against pins in the extremities of the chord line AC, the curve ABC will be described by the point B.

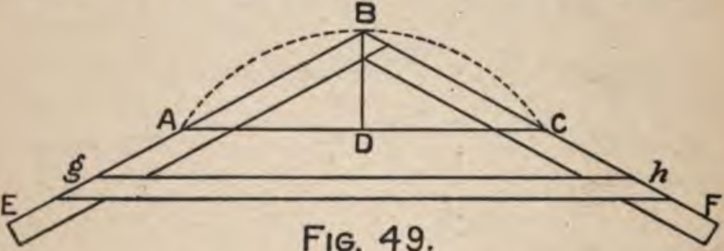


FIG. 49.

Problem 25.—Having the chord and versed sine of the segment of a circle of large radius given, **to find any number of points in the curve**

by means of intersecting lines: Let AC be the chord and DB the versed sine. Through B (Fig. 50) draw EF indefinitely and parallel to AC; join AB, and draw AE at right angles to AB. Draw also AG at right angles to AC, and divide AD and EB into the same number of equal parts, and number the divisions from A and E, respectively, and join the corresponding numbers by the lines, 11, 22, 33. Divide also AG into the same number of equal parts as AD or EB, numbering the divisions from A upwards, 1, 2, 3, etc.; and from the points 1, 2 and 3 draw lines to B and the points of interesection ot these with the other lines at h, k, l, will be points in the curve required. Same with BC.

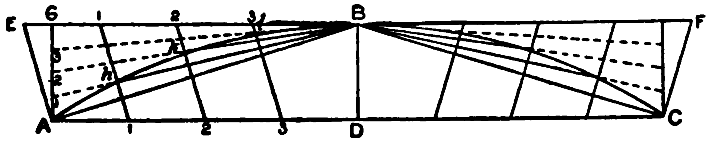


FIG. 50.

Problem 26.—**To draw an ellipse with the trammel:** The trammel is an instrument consisting of two principal parts; the fixed part in the form of a cross EFGH (Fig. 51), and the movable piece or tracer klm. The fixed piece is made of two rectangular bars or pieces of wood, of equal thickness, joined together so as to be in the same plane. On one side of the frame so formed, a groove is made, forming a right-angled cross. In the groove two studs, k and l, are fitted to slide freely and carry attached to them the tracer klm. The tracer is generally made to slide through the socket fixed to each stud, and provided with a screw or wedge, by which the distance apart of the studs may be regulated. The tracer has another slider m, also adjustable, which carries a pencil or point. The instrument is used as follows: Let AC be the major, and HB the minor axis of an ellipse: lay the cross of the

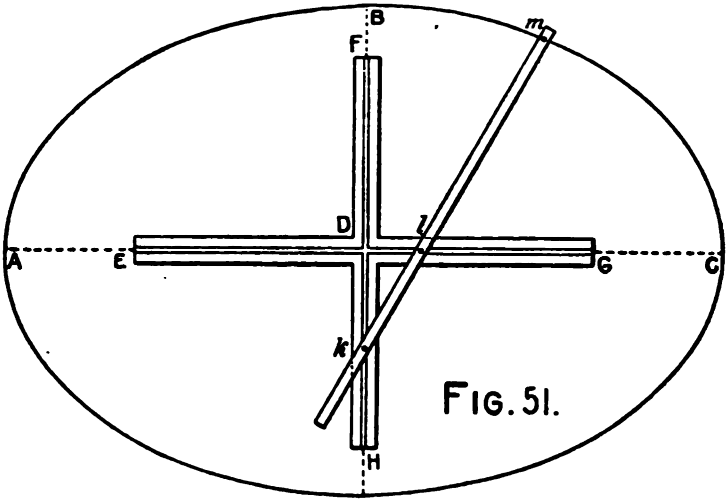


FIG. 51.

trammel on these lines, so that the center lines of it may coincide with them; then adjust the sliders of the tracer, so that the distance between k and m may be equal to half the major axis, and the distance between l and m equal to half the minor axis, then by moving the bar around, the pencil in the slider will describe the ellipse.

Problem 27.—**An ellipse may also be described by means of a string:** Let AB (Fig. 52) be the major axis, and DC the minor axis of the ellipse, and FG its two foci. Take a string EFG and pass it over the pins and tie the ends together, so that when doubled it may be equal to the distance from the focus F to the end of the axis, B; then putting a pencil in the bight or doubling of the string at H and carrying it around, the curve may

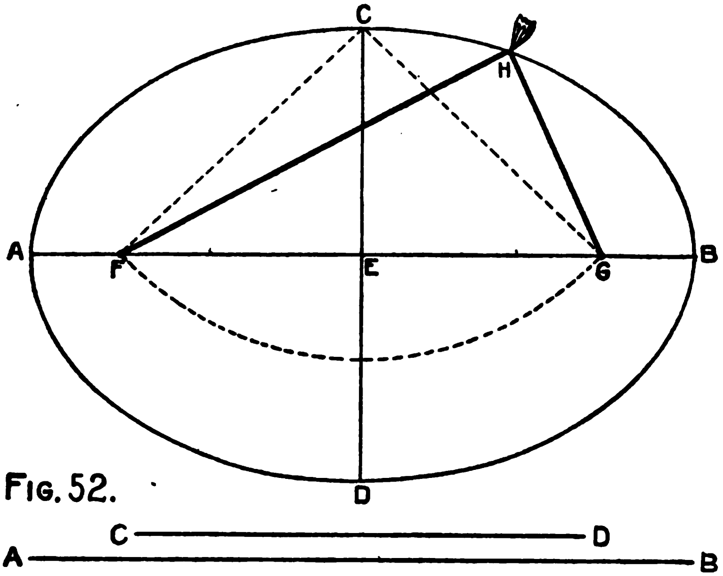


FIG. 52.

be traced. This is based on the well-known property of the ellipse, that the sum of any two lines drawn from the foci to any points in the circumference is the same.

Problem 28.—**The axes of an ellipse being given, to draw the curve by intersections:** Let AC (Fig. 53) be the major axis, and DB half the minor axis. On the major axis construct the parallelogram AEFC, and make its height equal to DB. Divide AE and EB each into the same number of equal parts, and number the divisions from A and E, respectively; then join A1, 12, 23, etc., and their intersections will give points through which the curve may be drawn.

Problem 29.—**To describe with a compass a figure resembling the ellipse:** Let AB (Fig. 54) be the given axis, which divide into three equal parts at the points fg. From these points as

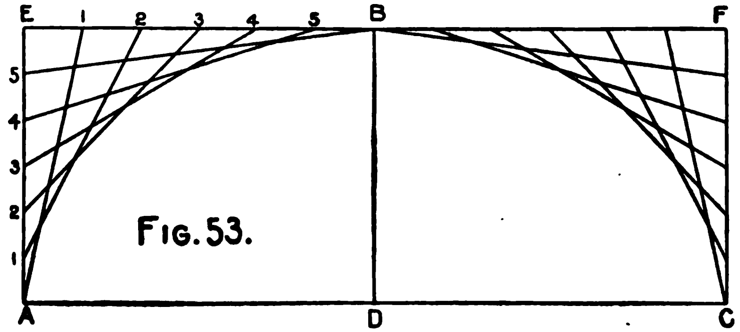


FIG. 53.

centers, with the radius Fa, describe circles which intersect each other, and from the points of intersection through f and g, draw the diameters CgE, CfD. From C as a center, with the radius CD, describe the arc DF, which completes the semi-ellipse. The other half of the ellipse may be completed in the same manner, as shown by the dotted lines.

Problem 30.—**Another method of describing a figure approaching the ellipse with a compass:** The proportions of the ellipse may be varied by altering the ratio of the divisions of the diameter, as thus: Divide the major axes of the ellipse AB (Fig. 55), into four equal parts, in the points fgh. On fh construct an equilateral triangle fCh, and produce the sides of the triangle Cf, Ch indefinitely, as to D and E. Then from the centers f and h, with the radius Af, describe the circles

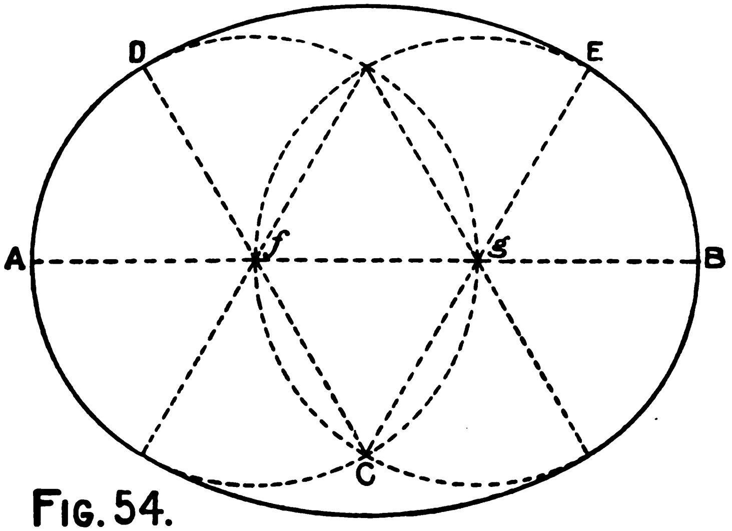


FIG. 54.

ADg, BEg; and from the center C, with the radius CD, describe the arc DE to complete the semi-ellipse. The other half may be completed in the same manner. By this method of construction the minor axis is to the major axis as 14 is to 22.

Problem 31.—**To find how far apart to saw kerfs to spring a board or moulding:** Let ab (Fig. 56) be the curve, around which it is desired to spring a piece of stock. Take a piece of stock dg of the thickness which is to be used. Lay it down so that the edge shall pass through the center c, and mark from c to g, and also at e.

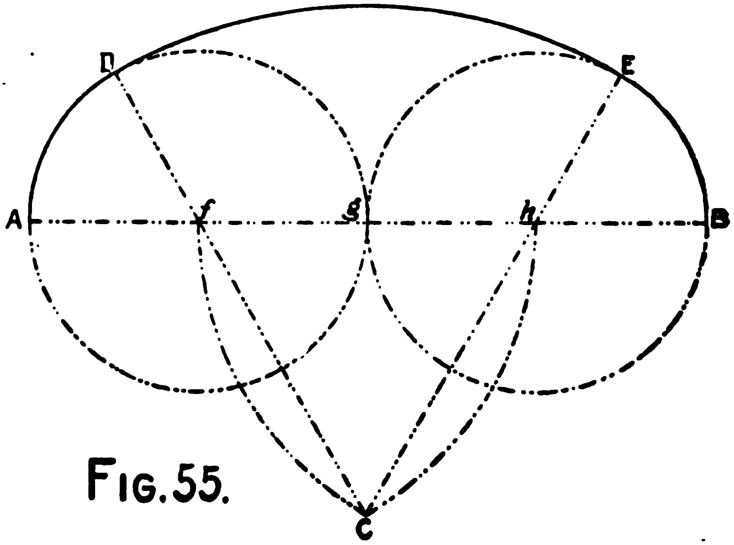


FIG. 55.

Now, with the saw which is to be used, make a kerf nearly through the piece of stock at c. Keeping this piece on the line cg, spring down

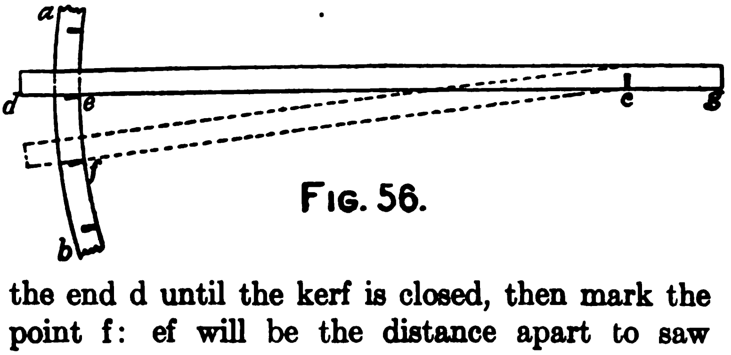


FIG. 56.

the end d until the kerf is closed, then mark the point f: ef will be the distance apart to saw kerfs.

Part II

ARCHES, CENTERS, WINDOW AND DOOR HEADS.

An arch — Semi-circle arch — Segmental arch — Horse-shoe arch — Lancet arch — Pointed arch — Tudor arch — Gothic architecture — Equilateral arch — Different parts of an arch — Six pointed star — Tracery in a square panel — Foliations

As it is also the business of the carpenter to prepare patterns for stone cutters, by which they are to cut stones to fit arches, centers for windows and door heads, it is necessary he should have a clear conception of what an arch really is. For if a positive conclusion has not been arrived at, and if the arch principle is not fairly understood, he cannot be expected to design an arch, or to construct it with accuracy or intelligence, even if designed by another. Let us then state once for all, that every curved covering to an opening is not necessarily an arch. Thus, the stone which rests on the piers shown in Fig. 57 is not an arch, being merely a stone hewn out in an arch-like shape; for at its top, the very point A at which strength is required, it is the weakest, and would fracture the moment any great weight was placed upon it.

It is not the province of this work to enter into a scientific discussion on the arch, but some of its properties must be known to the mechanic before he will be able to construct centers understandingly; and the general principles here laid down will help the workman materially to form correct ideas concerning the work in hand.

The Arch is an arrangement for spanning large openings so arranged that they may, by mutual pressure, support not only each other, but any weight that may be placed upon them.

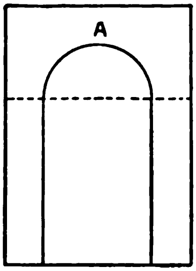


FIG. 57.

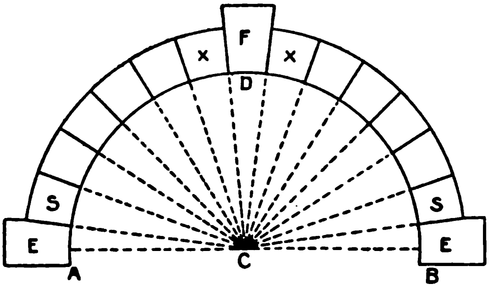


FIG. 58.

The leading principles in the construction of an arch are:

1.—That all the stones of which it is formed shall be of the form of wedges; that is, narrower at the inner than the outer end.

2.—That all the joints formed by the meeting of the slanting sides of the wedges should be radii of the circle, circles, or ellipse, forming the inner curve of the arch; and will, therefore, converge to the center or centers from which these are struck. As a rule, the arch answers the same purpose as the beam, but it is widely different in its action and in the effect that it has upon the appearance of a building.

A beam exerts merely a vertical force upon its supports, but the arch exerts both a vertical load and an outward thrust.

Before taking up the construction of the arch, we will define the terms relating to it.

Fig. 58 shows the different parts of an arch. The distance AB is called the span of the arch; the under surface, ADB, is called the intrados, and the outer the extrados; the distance, DC, is the rise; F is the keystone, the blocks X, X, of which the arch itself is composed are called voussoirs, and the lowest ones S, S, the springers. In arches whose intrados are not complete semicircles the springers rest upon two stones E, E, which have their upper surface cut to receive them; these stones are called skewbacks. The highest point in the intrados is called the vertex or crown, and the spaces between the vertex and the springing line AB are called the haunches.

Fig. 59 is the **semi-circle arch,** and was that principally used by the Romans, who employed it largely in their aqueducts and triumphal arches. The semi-circular and segmental arches are the best as regards stability, and are the simplest to construct.

Fig. 60 is a **segmental arch,** and is extensively used over window heads. A true segmental arch is one-sixth of the circumference of a circle, as shown in the figure.

Fig. 61 is an illustration of a segmental arch shown in connection with a window opening.

The Horse-shoe Arch.—This is almost restricted to the Arabian or Moorish style of architecture. In this form of arch the curve is carried below the line of center or centers, for in some cases the arch is struck from one center, and in others from two, as in Fig. 62.

Now it must be supposed that the real bearing of the arch is at the impost A A; for if this were really so, it must be seen that any weight or pressure on the crown of the arch would cause it to break at B; but the fact is simply that the real bearings of the arch are at B B, and the prolongation of the arch beyond these points is merely a matter of form and has no structural significancy. The Horse-shoe arch belongs especially to the Mo-

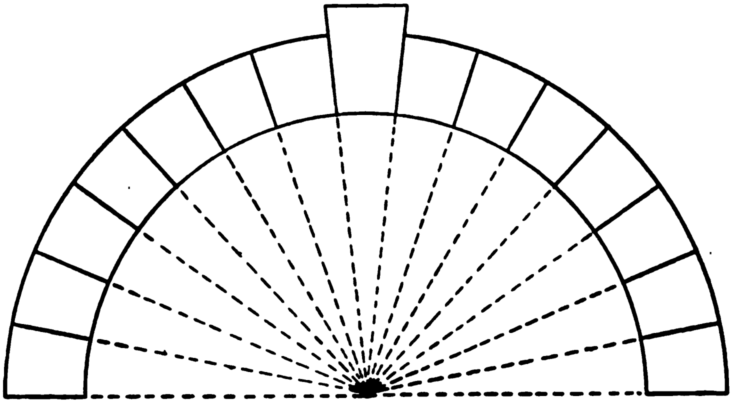


FIG. 59.

hammedan architecture, from its having originated with that faith and from its having been used exclusively by its followers.

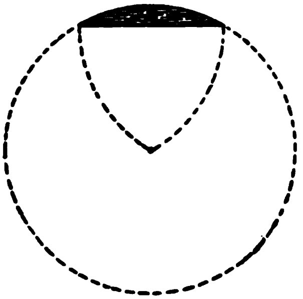


FIG. 60.

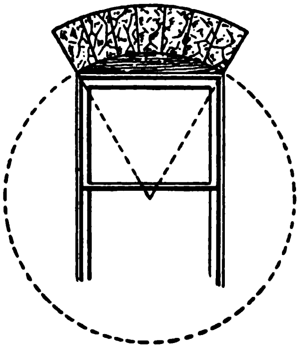


FIG. 61.

Next in point of time, but by far the most graceful in form, is the **pointed arch,** which is essentially the middle age style, and is capable of almost endless variety. Just where it originated

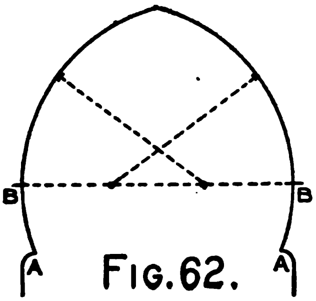


FIG. 62.

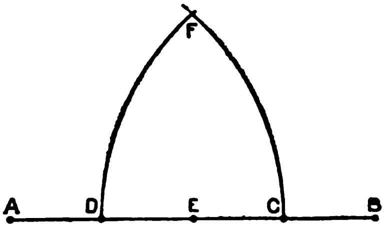


FIG. 63.

is hard to tell, as recent discoveries have shown that it was used many centuries ago in Assyria.

The greater or less acuteness of the pointed arch depends on the position of the centers from which the flanks are struck.

The Lancet Arch.—This arch indicates the style called "Early English," and is drawn as shown in Fig. 63. D C is the given span; bisect DC in E, make CB and DA equal to EC or ED; on B as center with DB as radius, describe the arc DF, and on A as center, describe the arc CF, and the arch is complete.

Equilateral Arch.—This arch (Fig. 64) is known as the Gothic Arch, and is constructed as follows:

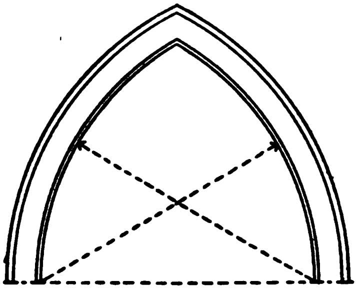


FIG. 64.

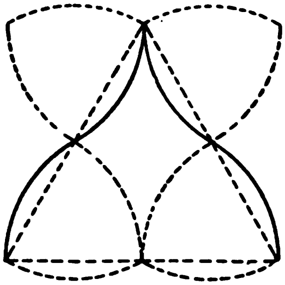


FIG. 65.

The radius with which the arcs are struck being equal to the span of the arch, and the centers being the imposts; and thus, the crown and the imposts being united, an equilateral triangle is formed. During the time that the Gothic arch was mostly used the Ogee arch (Fig. 65) was also occasionally used.

A little later on we find the **Tudor arches**, or four-centered arches (Fig. 66), in which two of the centers are on the springing line and two below it. The arches at the later period of this style became flatter and flatter, and this forms one of the features of Debased Gothic, when the beautiful and graceful forms of that style gradually decayed and for a time were lost. Happily in the present century there has been a gradual revival of the Gothic style, and works are now being produced which bid fair to rival in beauty of form and in principle of construction the marvelous buildings of the middle ages.

From the examples given the workman will be able to lay out any of the usual arches required in building.

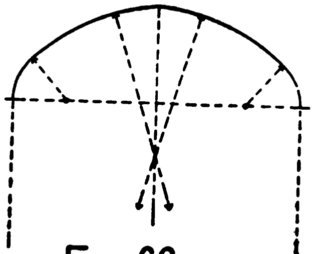


FIG. 66.

There are combinations, however, of these curves which the carpenter may be called upon to construct, such as the ones given herewith.

Fig. 67 is the elementary study upon which the subsequent figure is based. Having drawn the circle, describe on the diameter two opposite semi-circles, meeting at the center, a.

Divide one of these into six equal parts, and set off one of these sixths from i to n. Draw an, and divide it into four equal parts. From the middle point of a n draw a line passing through the center of the semi-circle, and cutting it in c. From c set off on this line the length of one of the fourths of a n. This point and the two in a n will be the centers for the interior curves.

Fig. 68 is the further working out of this elementary figure. It is desirable that a larger circle should be drawn. Then, when the figure has been carried up to the stage shown in the last, all the rest of the curves will be drawn from the same centers.

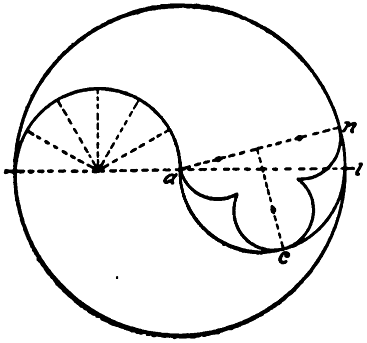


FIG. 67.

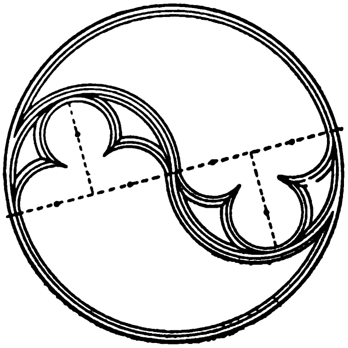


FIG. 68.

Fig. 69 and 70 are the elementary forms of the tracery shown in Fig. 71.

We show the method of obtaining these curves in Fig. 69: At any point, as at A, draw a tangent, and A G at right angles to it. From A, with radius O A, cut the circle in B and C, and the tangent in the point F, using B as a center. Bisect the angle O at F, and produce the bisecting line until it cuts A G in H. From O, with radius OH, cut the lines DC and EB in I and J. From H, I and J, with radius HA, draw the three required circles, each of which should touch the other two and the outer circle.

After having constructed Fig. 69 we go one step further and form Fig. 70; having inscribed three equal circles in a circle, join their centers, thus forming an equilateral triangle. From the center of the surrounding circle draw radii passing through the angles of the triangle and cutting the circle in points; as d and two others. Draw ed and bisect it by cg; then the centers for the curves which are in the semi-circle will be on the three lines, dc, cg and ce.

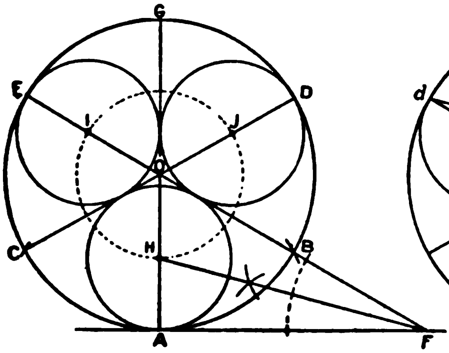


FIG. 69.

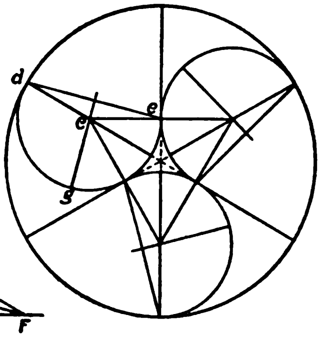


FIG. 70.

These curves, in Gothic architecture, are called **foliations,** or featherings, and the points at which

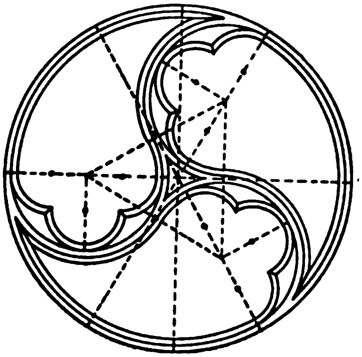


FIG. 71

they meet are called cusps. The completion of this study is shown in Fig. 71.

Fig. 72 is the elementary form of the tracery shown in Fig. 73.

Fig. 74 shows the elementary construction of Fig. 75. Draw two diameters (Fig. 74) at right angles to each other, and joint their extremities, thus inscribing a square in the circle. Bisect the quadrants by two diameters cutting the sides of the square in the points as g; join these points,

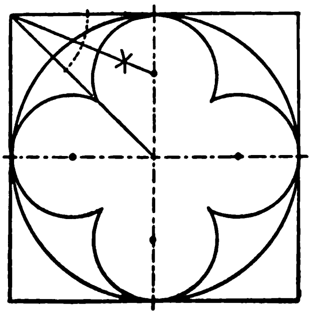


FIG. 72.

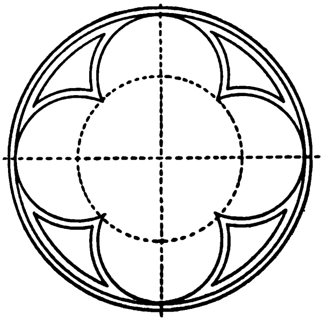


FIG. 73.

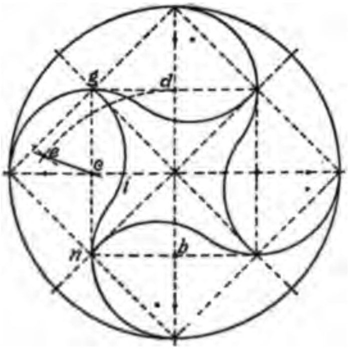


FIG. 74.

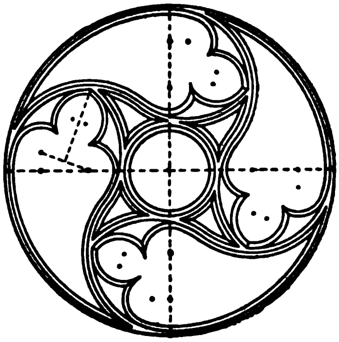


FIG. 75.

and a second square will be inscribed within the first.

The middle points of the sides of this inner square, as bcd, are the centers of the arcs which start from the extremities of the diameters.

From b, with radius bd, describe an arc, and from g, with radius gc, describe another cutting the former one in e. Then e is the center for the arc ig, which will meet the arc struck from b, in i. Of course, this process is to be carried on in each of the four lobes.

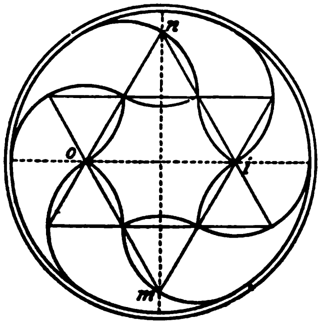


FIG. 76.

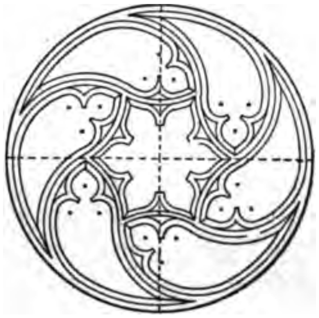


FIG. 77.

Fig. 75 is the completed figure.

Fig. 76 shows the skeleton lines of Fig. 77. Divide the diameter into four equal parts, and on the middle two, as a common base, construct the two equilateral triangles oin and oim.

Draw lines through the middle points of the sides of the triangles which, intersecting, will complete a six-pointed star in the circle, the angles of which will be the centers for the main lines of the tracery.

Fig. 77 is the completed figure.

The figures 78 and 79 will be understood without further instruction than is afforded by the examples.

Fig. 80 shows the construction for the tracery in a square panel. From each of the angles of the square (the inner one in this figure), with a radius equal to the length of the side of the square, describe arcs; these intersecting will give a four-

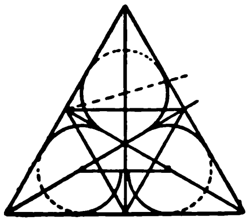


FIG. 78.

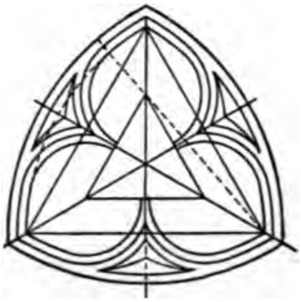


FIG. 79.

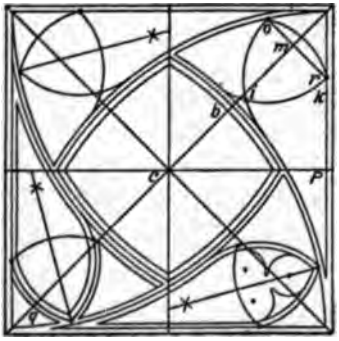


FIG. 80.

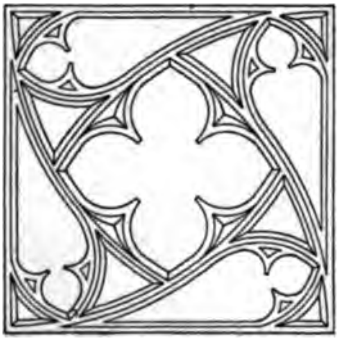


FIG. 81.

sided curvilinear figure in the center. Draw diagonals in the square.

From the point where the diagonal intersects the curve b (the middle line of the three here shown) set off on the diagonal the length cb, viz., bm. From q, with radius mq, describe an arc cutting the original arc in o. Make mr equal to m o.

From o and r, with radius o r, describe arcs intersecting each other in i: produce these until they meet the curve p in n.

The foliation and completion, as shown in Fig. 81, will be found simple.

Part III

THE STEEL SQUARE IN CARPENTRY. Bracc Rule—Octagon scale — Fence — Square and fence — Length of the common rafter — To find the pitches of roofs — Rafters — Reversed pitches — Laying out rafters—Hip-roof framing —To cut bed moulds for gable to fit under cornice

It is unnecessary to give a full and complete description of the steel square, as every carpenter and joiner is supposed to be the possessor of one of these useful instruments and know how to use it intelligently. The blade of the steel square should be 24 inches long and 2 inches wide, and the tongue 18 inches long and 1½ inches wide. The tongue should be exactly at right angles with the blade.

The next thing to be considered is the use of the figures, lines and scales, as exhibited on the square. It is supposed that the ordinary divisions and sub-divisions of the inch, into halves, quarters, eights and sixteenths are understood by the student; and that he also understands how to use that part of the square that is subdivided into twelfths of an inch.

Perhaps, with the single exception of the common inch divisions on the square, no set of figures on the instrument will be found more useful to the active workman than that known as the board measure, or board rule. If we examine Fig. 82 we will find under the figure 12, on the outer edge of the blade, where the length of the boards, plank or scantling to be measured is given, and the answer in feet and inches is found under the inches in width that the board, etc., measures. For example, take a board 9 feet long and 5 inches wide; then, under the figure 12, on the second line, will be found the figure 9, with is the length of the board; then run along this line to the figure directly under the 5 inches (the width of the board), and we find 3 feet 9 inches, which is the correct answer in "board measure." If the stuff is two inches thick, the sum is doubled; if three inches thick it is trebled, etc.

Brace Rule.—The brace rule is always placed on the tongue of the square, as shown in the central space at X, Fig. 82.

This rule is easily understood; the figures on the left of the line represent the run or the length of two sides of a right angle, while the figures on the right represent the exact length of the third side of a right-angled triangle, in inches, tenths, and hundredths. Or, to explain it in another way, the equal numbers placed one above the other, may be considered as representing the sides of a square, and the third number to the right the length of the diagonal of that square. Thus the

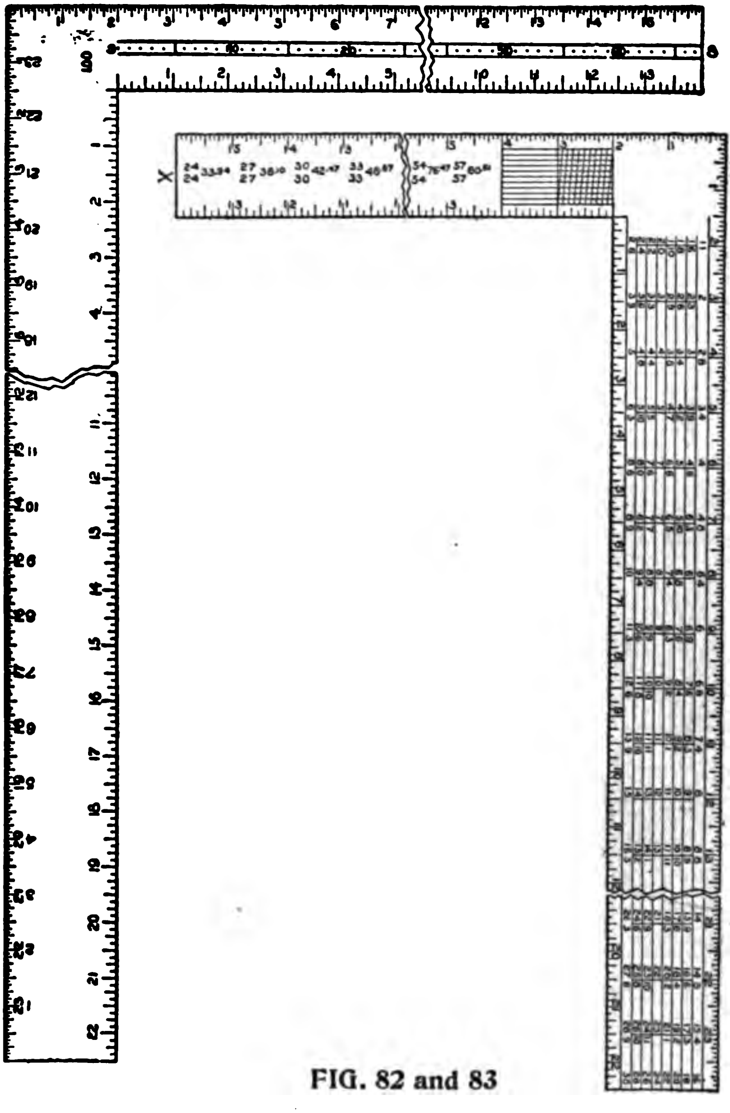


FIG. 82 and 83

exact length of a brace, from point to point, having a run of 33 inches on a post and a run of the same on a girt, is 46.67 inches. The brace rule varies somewhat in the matter of the runs expressed in different squares. Some squares give a few brace lengths of which the runs upon the post and beam are unequal.

Octagon Scale.—The octagonal scale, as shown on the central division of the upper portion of the blade, is on the opposite side of the square to the brace rule, and runs along the center of the tongue as at S S, Fig. 83. Its use is as follows: Suppose a stick of timber ten inches square. Make a center line, which will be five inches from each edge; set a pair of compasses, putting one leg on any of the main divisions shown on the square in this scale, and the other leg on the tenth division. This division, pricked off from the center line on the timber on each side, will give the points for the gauge lines. Gauge from the corners both ways, and the lines for making the timber octagonal in its section are obtained. Always take the same number of spaces on your compasses as the timber is inches square from the center line. The rule always to be observed is as follows: Set off from each side of the center line upon each face as many spaces by the octagon scale as the timber is inches square. For timbers larger in size than the number of divisions in the scale, the measurements by it may be doubled or trebled, as the case may be.

Fence.—A necessary appendage to the steel square in solving problems is the fence, which nearly every carpenter knows the value of. We illustrate in Fig. 84 a wooden fence which was formerly used altogether, and in many places still used although the steel fence can now be purchased in any hardware store.

Fig. 85 shows the square and fence together; the fence can be adjusted so as to slide up and down the tongue and blade until it is in the position desired; to show the fence and square in practical use take the square as arranged in Fig. 85 and place it on the prepared board, as shown in Fig. 86. Adjust the square so that the 12-inch lines coincide exactly with the gauge line O, O, O, O. Hold the square firmly in the position now obtained and slide the fence up the tongue and blade until it fits snugly against the

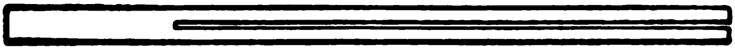


FIG. 84

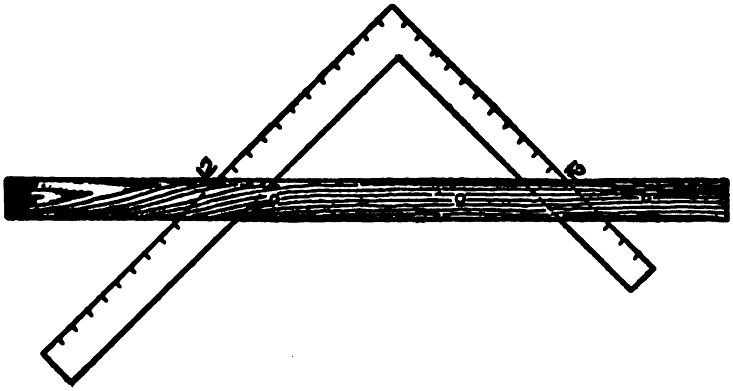


FIG. 85

jointed edge of the board, screw the fence tight on the square, and be sure that the 12-inch marks on both the blade and the tongue are in exact position over the gauge line.

We are now ready to lay out the pattern. Slide the square to the extreme left, as shown on the dotted lines at X, mark with a knife on the outside edges of the square, cutting the gauge line. Slide the square to the right until the 12-inch mark on the tongue stands over the knife mark on the gauge line; mark the right-hand side of the square cutting the gauge line as before; repeat the process four times, marking the extreme ends to cut off, and we have the length of the brace and the bevels.

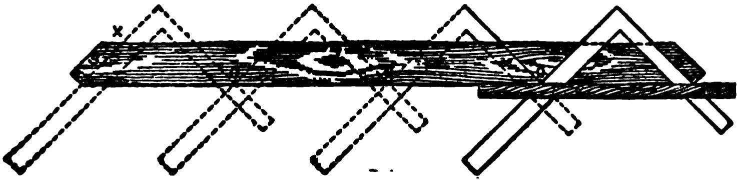


FIG. 86

Fig. 87 shows the brace in position, the dotted lines show where the square was placed on the pattern.

We will briefly explain some of the things that can be more readily done with the steel square than by any other method.

One of the best uses to which the steel square can be put is to find the pitches of roofs, which is a subject not as well understood as it should be.

The word pitch has reference to the rise given the common rafter in proportion to the span. Therefore, by letting 12 on the tongue represent the run of the common rafter, the figures on the blade will then represent the rise in proportion to its length (the blade), as 6 being one-fourth of 24

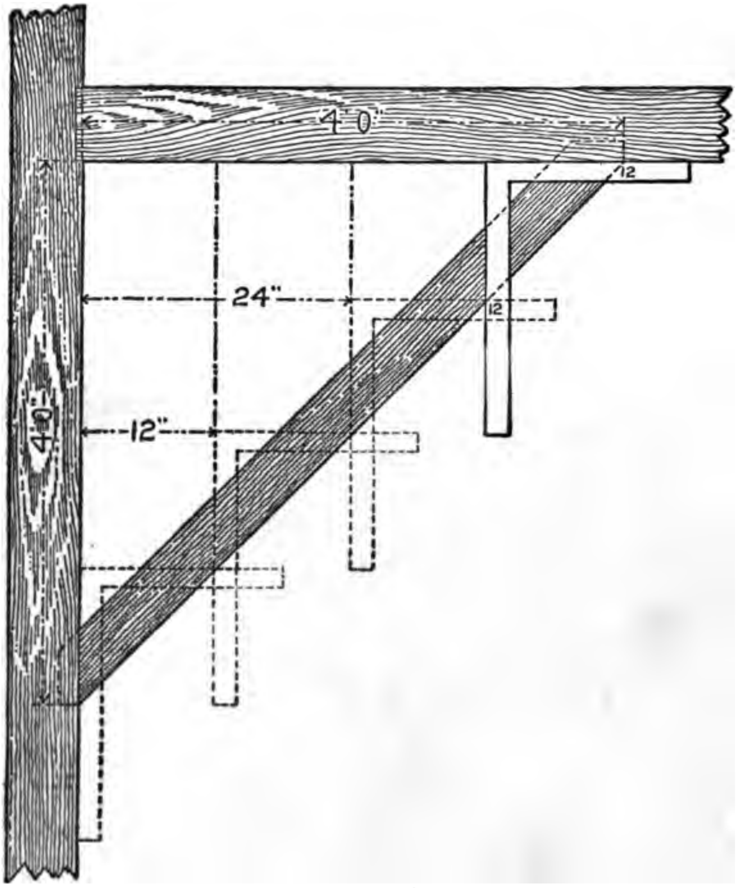
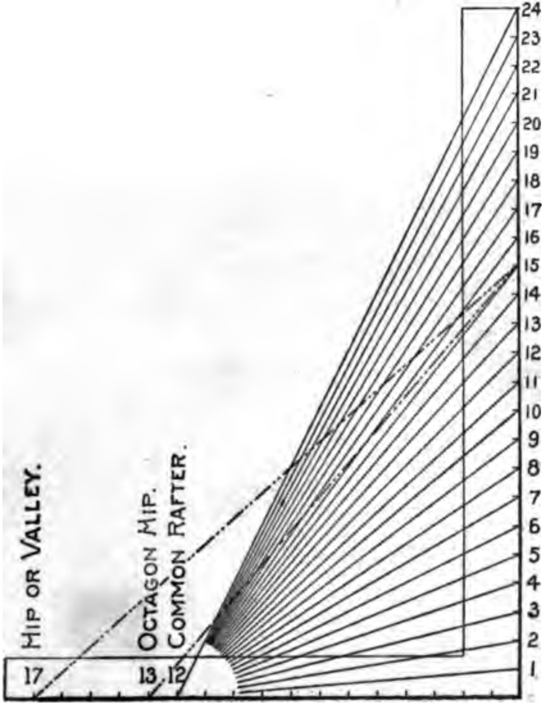


FIG. 87

represents the quarter pitch, 8 represents the one-third pitch, 12 the one-half pitch, etc. See illustration Fig. 88.

For the corresponding hip or valley for the octagon or square-cornered building, substitute 13 and 17 on the tongue, respectively. However, neither is absolutely correct, but near enough for practical purposes.



Rise	Pitch	Degrees		Reversed Pitch
24	1	63°	26"	1/4
23	23/24	62°	27"	6/23
22	11/12	61°	23"	3/11
21	7/8	60°	17"	2/7
20	5/12	59°	2"	3/10
19	19/24	57°	44"	6/19
18	3/4	56°	19"	1/3
17	17/24	54°	47"	6/17
16	2/3	53°	8"	3/8
15	5/8	51°	21"	2/5
14	7/12	49°	24"	3/7
13	13/24	47°	18"	6/13
12	1/2	45°	0"	1/2
11	11/12	42°	31"	6/11
10	5/12	39°	48"	3/5
9	3/8	36°	53"	2/3
8	1/3	33°	41"	3/4
7	7/24	30°	15"	6/7
6	1/4	26°	34"	1
5	5/24	22°	37"	1 1/5
4	1/6	18°	26"	1 1/2
3	1/8	14°	2"	2
2	1/12	9°	28"	3
1	1/24	4°	46"	6

FIG. 88

The lengths taken diagonally from 12, 13 and 17 on the tongue to the figures designating the rise on the blade represent the lengths of the above rafters for a one-foot run. The diagonal lines in the illustration from those figures to 15 on the blade represent five-eighths pitch. Only three of the lengths out of seventy-two are without fractions and they are for the common rafters, as follows: 12 to 5-13 inches, 12 to 9-15 inches, and 12 to 16-20 inches. It is on the latter that the rule 6, 8 and 10, so generally used for squaring frame work, is founded. Of course, any of the other angles could be used for this purpose; but the above being without fractions are therefore easy numbers to remember.

The length of the common rafter doubles its run or has a length equal its span when it has a rise of 60 degrees which, taken on the square, is 20.784 inches rise to the foot. The same occurs of the octagon hip when it has a rise of a fraction less than 23 inches, and that for the common hip at nearly 29½ inches rise to the foot.

In the illustration the reversed pitches are also given, that is by letting the blade represent the run and the tongue the rise. The length of the diagonal lines in that case becomes the length of the rafter for a one-foot rise to the inches in run taken on the blade.

The reader will notice that several of these pitches are transposed and are found in the first column, as follows: The one pitch is the same as the one-quarter when reversed. The three-quarters the same as the one-third. The two-thirds same as three-eighths. The one-half remains the same or unchanged. The low pitches in the first column become very steep when reversed; thus, the one-twenty-fourth pitch becomes six pitches or a rise of 12 feet to a one-foot run. The one-twelfth pitch is equal to a rise of 6 feet to a one-foot run, etc.

Rafters.—Laying out rafters with the aid of the square, we proceed as follows: In Fig. 89 it will be noticed that the rafter is for quarter pitch, and for convenience it is supposed to consist of a piece of stuff 2 inches by 6 inches by 17 feet. That portion of the rafter that projects over the wall of the building and forms the eave, is any length desired. The length of the projecting piece in this case is one foot—it may be more or less to suit the eave, but the line must continue from end

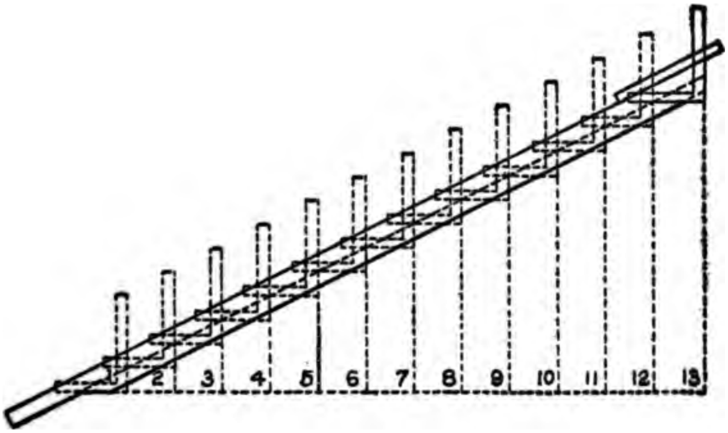


FIG. 89

to end of the rafter, as shown on the plan, and we will call this line our working line.

We are now ready to lay out this rafter, and will proceed as follows: We adjust the fence to the square the same as for the braces, press the fence firmly against the top edge of the rafter, and place the figure 12 inches on the left-hand side, and the figure 6 inches on the right-hand side directly over the working line, as shown in the plan. Be very exact about getting the figures on the line, for the quality of the work depends much on this; when you are satisfied that you are right, screw your fence tight to the square. Commence on No. 1 on the left and mark off on the working line; then slide your square to No. 2, repeating the marking, and continue the process until you have measured off thirteen spaces, the same as shown by the dotted lines in the drawing. The last line on the right-hand side will be the plumb cut of the rafter and the exact length required, which will be found to be 14 feet 6½ inches, plus the projection given the eave. It will be noticed that the square has been applied to the timber thirteen times.

The reason for this is, that the building is 26 feet wide, the half of which is 13 feet, the distance that one rafter is expected to reach; so, if the building was 30 feet wide, we should be obliged to apply the square fifteen times instead of thirteen. We may take it for granted, then, that in all cases where this method is employed to obtain the lengths and bevels, or cuts of rafters, we must apply the square half as many times as there are feet in the width of the building being covered. If the roof to be covered is one-third pitch, all to be done is to take 12 inches on one side of the square and 8 inches on the other and operate as for quarter pitch.

Whenever a drawing of a roof is to be followed we can soon find out how to apply the square by laying it on the drawing, as shown in Fig. 90. Of course, something depends on the scale to which the drawing is made. If any of the ordinary fractions of an inch are used, the intelligent workman will have no difficulty in discovering what figures to make use of to get the cuts and lengths desired.

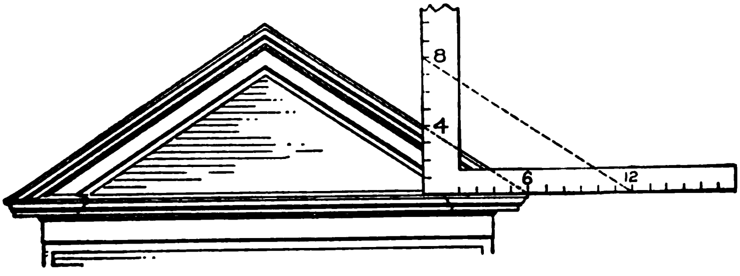


FIG. 90

Hip-roof Framing.—In framing a hip-roof we will take the one-third pitch. We first lay off the common rafter, which has been previously explained, and in order to avoid making a plan, we give a formula in figures. The pitch which we have taken is one-third the width of the building to point of rafter from wall plate or base. For example, always 8, which is one-third of 24, on tongue for altitude; 12, one-half the width of 24, on blade for base. This cuts common rafter. Next is the hip rafter. It must be understood that the diagonal of 12 and 12 is 17 in framing, and the hip is the diagonal of a square added to the rise of roof; therefore, we take 8 on tongue and 17 on blade; run the same number of times as common rafter; these figures also give the seat and plumb cut of the hip. To cut jack rafters, divide the number of openings, for common rafter. Suppose we have five jacks, with six openings, our common rafter is 12 feet long, each jack would be 2 feet shorter. First 10 feet, second 8 feet, third 6 feet, etc. The plumb cut is the same as for the cut of common rafter; seat cut also the same as for common rafter. To cut miter to fit hip: Take half the width of building on tongue and length of common rafter on blade; blade

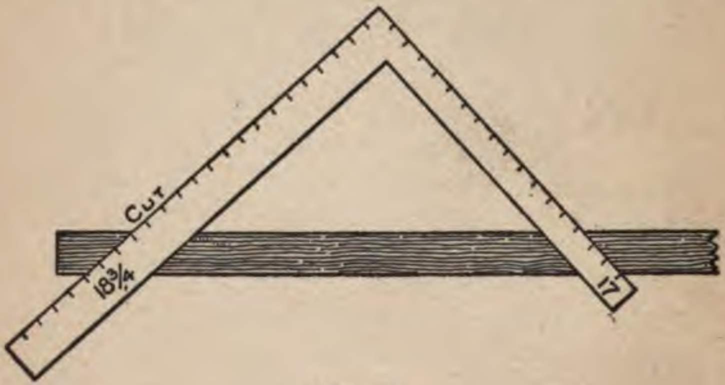


FIG. 91

gives cut; or, the same result may be found by taking the diagonal of 12 and 8, which is 14 7-16, then take 12 on the tongue, 14 7-16 on blade; blade gives cut. In connection with the hip there must be another cut considered, called the side cut of the hip; though the angle to obtain this cut is across the top or back of rafter. Were there no slope to the roof, this angle where it meets the ridge pole would be an angle of 45 degrees; but when a slope is given this angle becomes more acute. The rule is: take the length of the hip on blade and its run on tongue, the blade gives the cut, or take 17 on the tongue and 18¾ on the blade; blade gives the cut, as shown in Fig. 91.

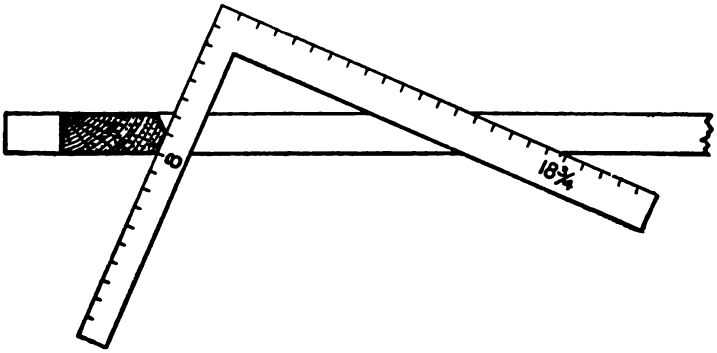
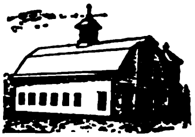


FIG. 92

The hip rafter should be beveled so as to be in plane of the common rafter; height of hip on tongue, length of hip on blade; tongue gives bevel, or we take 8 on tongue, 18¾ on blade, tongue gives bevel, as shown in Fig. 92. These figures will cover all cuts in putting on cornice and sheathing.

To cut bed moulds for gable to fit under cornice, take half the width of the building on tongue, length of common rafter on blade; blade gives cut. Machine mouldings will not member, but this gives a solid joint; and to member properly it is necessary to make moulding by hand, the diagonal plumb cut differences. We find many mechanics puzzled to make the cuts for a valley. To cut planceer, to run up valley, take height of rafter on tongue, length of rafter on blade; tongue gives the cut. The plumb cut takes the height of hip rafter on tongue, length of hip rafter on blade; tongue gives the cut. These figures give the cuts for one-third pitch only, regardless of width of building.



Part IV

HOUSE FRAMING. Framing a house — Good and faulty construction—Constructing the sill—Construction at the bearing of second floor joist — Construction of cornice — Constructing box sills—Framing ordinary studding — Constructing a porch— Cutting window openings — Framing sills — Method of halving sills- -Making a good corner—Framing a joist bearer—Method of setting studding — Constructing a cornice — Cutting openings in frame work—Affixing of joinery work, Etc.

Framing a House.—Some thirty-five or forty years ago when lumber was more plentiful, it was the common practice to build frame houses, great and small, with solid timbers. The sills, plates and corner posts were often hewn from the round timber with broad ax and adz, often taking months in preparing these for the "new house." In fact, it was quite the custom to commence the year before to get out the timbers, preparatory for the day of "house raising." After the timbers were hewn to the desired size, then came the work of laying out the mortise and tenons for joining the different parts together. No nails or spikes being used for this work. The corner posts were usually made out of timbers six or eight inches square with the inner corner hewn out to receive the lath and plaster. Think of doing that kind of work nowadays. This carries us back to the time of the building of our old home, now more than forty years ago; though only a lad we remember the time the trees were being felled in the forest and after a long wait for the timbers to be squared, they were hauled to the building site, and after a time for them to season, the carpenters came, and as though but yesterday, we see them under the old apple trees astride the timbers with auger, chisel and mallet working away from morn till night. It was just so with all of the work connected with the building. The mill work was gotten out by hand, even to the sash and doors. How well they built their works remains as a silent witness; suffice it to say the latter day workmen could gain some good pointers in construction from these old timers. Neither short hours, long hours, strikes nor lockouts worried them. Those were days of toil, days of contentment and peace. How different it is now! When the new house is decided upon, within sixty or ninety days it is ready to move into. The work is divided up into different classes and done by different workmen. The solid timbers are no longer used for the frame work. In its stead the sills and other timbers are built up with joists and studding commonly known as balloon framing, and everything is rushed from start to finish, and in the hurry many things that should be done are overlooked to the detriment of the house. Some of these things may require but little or no extra expense, if attended to at the proper time, but if neglected prove a serious detriment to the building. It is to this phase of the question that we desire most to call attention.

Good and Faulty Construction.—In Fig. 93 are shown two ways of constructing the sill; however, there are several ways, but these will serve our purpose. The one shown at A is marked "faulty," and that at B is marked "good construction." At A the masonry projects a little beyond the base board and the sill is laid without being bedded in mortar. The water follows the woodwork and runs or beats under the sill, the inequalities of the stone holding the water and in a few years the sill is rotted out, to say nothing of the cold that the open crevices will let in. The studding are halved to allow nailing space to the sides of the joists, but in doing this a space between the studding is left open, allowing free circulation, as shown by the course of the arrow. In the construction at B the sheathing is flush with the

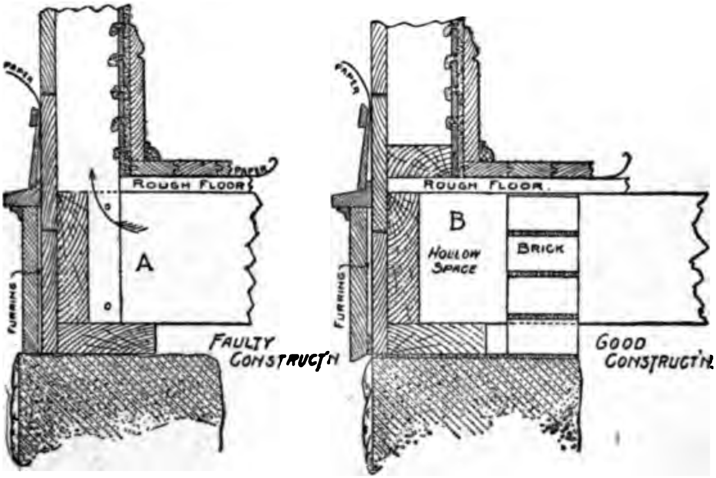


FIG. 93

mason work, and the base sets clear and a little below the top edge of the stone. The back edge of the base is beveled so as to form a drip. The sills are bedded in mortar and the spaces between the joist and studding are cut off. Bricks are used to fill in between the joist but in this allowance should be made for shrinkage of the timbers by leaving the masonry work a little below the top edge of the joist. The building paper extends from sill to plate and under window and door frames.

In Fig. 94 are shown two forms of construction at the bearing of the second floor joist. The construction shown at C is the usual way most two-story houses are built. No attempt being made

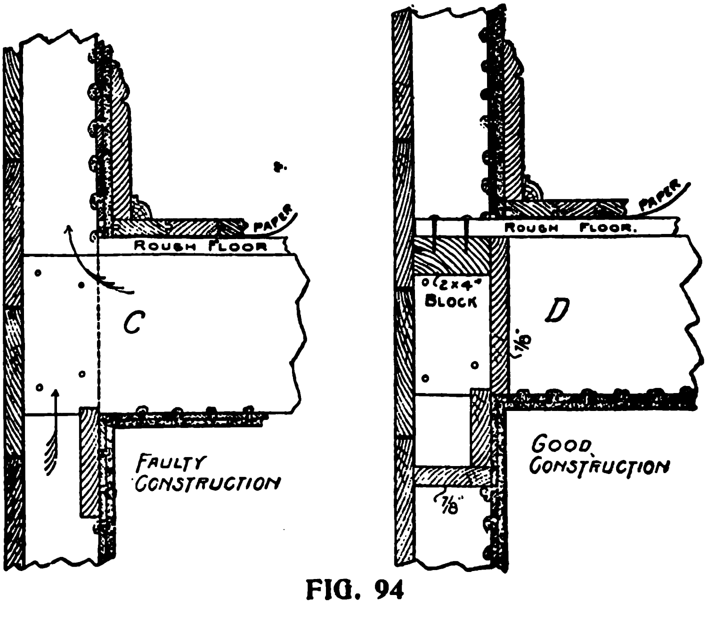


FIG. 94

to cut off the space between either studding or joist. At D is shown what should be done. Two by four-inch pieces are set in between the studding on a level with the top of the joist. The rough flooring should be laid diagonally with the joist and extend over on to these pieces and nailed. This forms a good tie and makes a closed job and by cutting in $\frac{7}{8}$-inch boards between the joist, letting the lower edge lap over the bearing board will cut off the space between the joist. If back plastering is desired a third piece should be cut in between the studding just beneath the bearing board for the back plaster to stop against same.

In Fig. 95 are shown faulty and good construction of cornice and bearing of the ceiling joist. At E is the usual way of construction for cottages

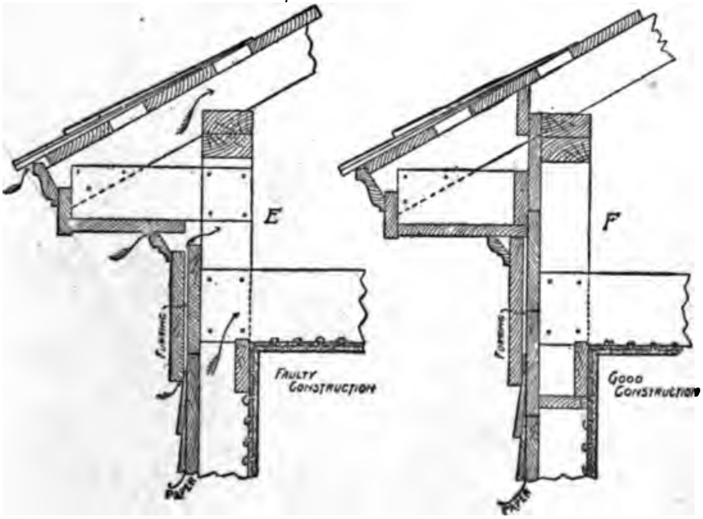


FIG. 95

where the ceiling is lower than the plate. The space between the studding is left open and is otherwise built on a refrigerator plan. Great open cracks are left between the frieze and plancier with the idea of covering with the bed mould. After the natural shrinkage of the different members, small crevices are open up to huge proportion and the frosts and cold winds find their way in to compete with the burning coals for supremacy. As the heat rises and warms the attic, the cold air seeks the lower level, and if by faulty construction, as before mentioned, in the lower parts of the house, it has a perfect current of cold air sweeping through these spaces and the result is a cold house. At F is shown how these defects could have easily been remedied at a very little extra expense. But it does not stop here, for there are many other parts in and about the house that are constructed on the same principle. Gable studdings are oftentimes continuous from sill to the rafter instead of the plate across the end, thereby leaving an open space the whole way down. The pockets for the sliding doors are often not closed from the surrounding openings. In case of fire getting started every opening is a ready flue to fan on the flames. On the other hand, with these flues cut off, fire is not nearly so apt to get started and if it does it will take much longer time to consume the building, and the chances are much better for saving the house. The builders are not so much to blame for this kind of work, but rather the architect who should show these things in the plans and specifications and see that it is done. Otherwise, in these days of close competition, the contractor must figure close, and unless these things are clearly shown and described he cannot reasonably be expected to do it unless all are required to do the same.

Constructing Box Sills.—Fig. 96 shows several ways of constructing box sills, commonly called

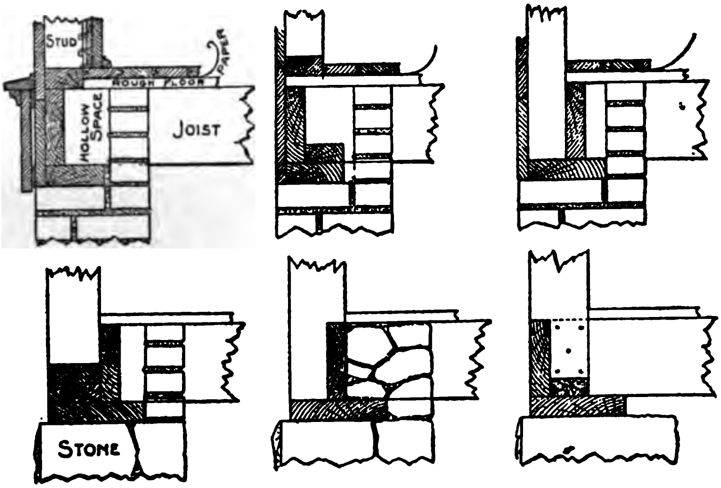


FIG. 96

balloon framing. The first one shown at the upper left-hand corner is the same as that shown in the previous illustration for good construction, and what is said in its favor is not necessary to repeat here. However, the section here shown is that resting at right angles to the joist. The side section should have an extra joist with ⅞-inch blocks set in between for the plate or shoe to rest on, so as to form a projection to receive the ends of the flooring. In long spans there should also be cross-pieces set in between the sill and the adjacent joist, as a further precaution to keep the sill from springing outward. The other types here shown are good forms of construction for general residence work, and are here given to meet the requirements that may arise. It is quite frequently necessary to change, so as to make the lumber at hand work to the best advantage to give desired heights, etc. But whatever style is used, there should be great care taken to break the joints of the different members; that is, do not let two joints come at the same place, but equalize them as much as possible. Another point should not be overlooked, and that is the beam filling. This is done principally to keep out the cold. It is quite the custom to fill in the space between the joist with broken stone or bats, slushed with coarse mortar, which, of course, makes a tight job; but the experience of the writer has been that it is not a good one for several reasons, which are as follows:

First—unless the sill is built water-proof, after forms as previously illustrated, it is only a question of a few years until the sill is rotted out. Then, again, if is is built perfectly tight dry rot is liable to make quite as quick destruction; besides the joist are sure to shrink more or less, so something has to give, and it is usually a bulged floor, as the result. The better method is to fill in with brick, leaving an air chamber back of same and make allowance for the shrinkage by not filling flush with the top edge of the joist at first; then after a time, if a tighter job is wanted, it can be pointed.

Framing Ordinary Studding.—Volumes could be written on roof framing alone and yet not completely cover the subject. We will mention a few simple matters of the most common framing. The best way to frame ordinary studding or joist is to make a good pattern of one, and for two men, one at each end to lay the pattern on and mark off the rest. Of course, in very heavy work it is well to make a pattern out of lighter material. It happens many times that one man is left to frame alone, and it is very inconvenient, especially in long work, to go back and forth to mark both ends. It is very handy to use a pattern on each side and square over and lay off a dozen or so at a time, as illustrated in Fig. 97. Here we show a long studding notched for ribbon to put second floor joist on. This used to be con-

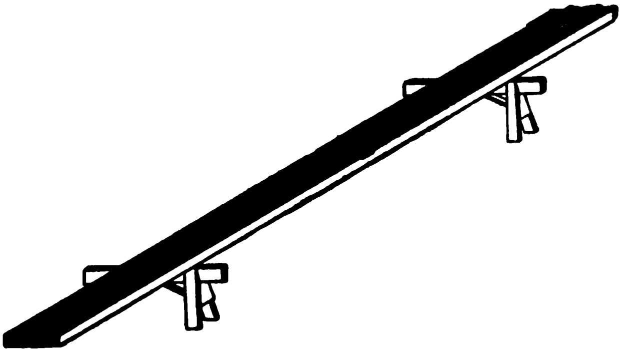


FIG. 97

sidered much better than short studding for each story, but the majority seem to prefer the short studding for each story, as it is surely much easier to handle and, if properly made, is fully as strong.

Of course, it could be made weak by only slightly nailing the upper studding and have a crack in the lining just at the bottom of the upper studding, etc., but these matters can be easily avoided and should be. The long studding can be made weak, and often are by carelessly sawing them almost in two when sawing for ribbon. Again, we often see a very weak building of this kind because many of the joists simply rest on the ribbon and are not spiked to the studding at all. Most of these weak points in either style could and should be avoided. The British Government has shear legs in their dockyard at Chatham that will raise a dead weight of 180 tons out of a ship and into the air 60 feet and place it in another ship, and it makes one realize that raising is a big subject, too.

But it is not the difficult things to raise that it is intended to call attention to as much as the simple and common ones. With all the modern derricks and shear legs and old-fashioned spike poles, which are all very useful in raising, the main thing necessary in ordinary house construction is plenty of men. A few to hold down the foot and plenty to raise the studding and the complete wall of a house goes up very quickly and easily.

While it is very necessary to have plenty of men it sometimes happens that we do not have them. Then by nailing together a section at a time, and having a lining board nailed at the bottom to hold the foot down and a studding at each end with a spike in each to help hold it, it is raised as illustrated in Fig. 98. Where there is plenty of help always finish the openings complete before raising, as it is much easier while the studdings are lying down than it is to climb up and cripple them in.

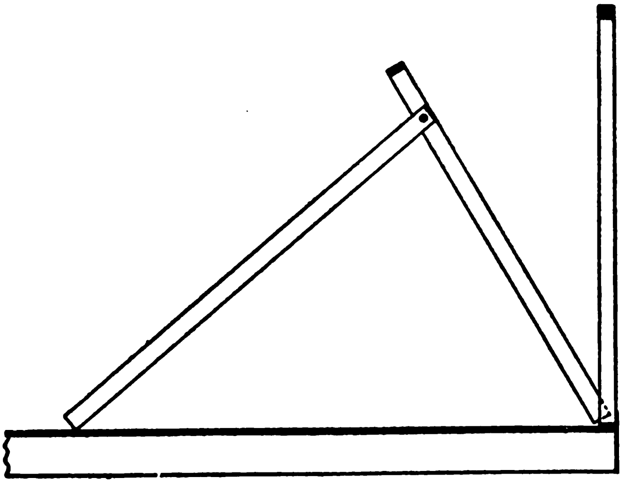


FIG. 98

Fig. 99 illustrates a section complete. A common window opening may be made with single studding and headers flat ways; but for larger openings they should be doubled and the header put up on edge and, where necessary, a brace

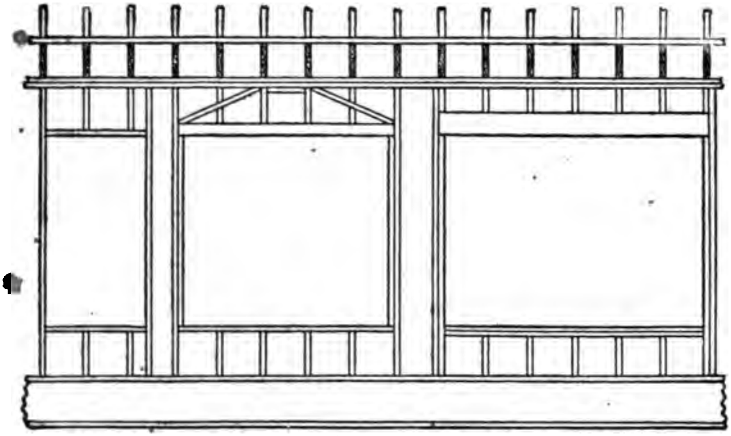


FIG. 99

should be cut in to form a kind of truss. For a very large opening that kind of crippling generally makes a very poor job, and a much better way is to use a joist of sufficient width and strength. Many times we see a house with single dressed plate, which is only a little over 1½ inches to carry heavy 12-inch joist, and the joist spaced without any regards for the studding below.

While it is true that the joist will probably not break through the plate, still how much better it would be to space the joist so they would come over the studding. In fact, it is not only much better, but it is much easier, too, for you to simply lay off the sill, and it is all carried along with that one laying off. Studding and joist are all 16 inches apart all over the building and ready to receive the lath.

There is no time spent at all for laying off the second floor except for laying out for the openings.

Constructing a porch.—Fig. 100 shows the general construction and details in full of the framing and the various parts of an ordinary front porch. A special feature in the framing of this porch is the joists, which in most porches must also answer for the outside sills. In framing porches many carpenters and contractors frame the joists so that there is nothing but the narrow edge of a 2 by 6 or 2 by 8 that rests on the porch piers, and this small bearing, of course, must come all on the outside edge of the piers.

By the method which we refer to in our detail we take a 2 by 6 and a 2 by 8 and spike them together, as shown in the detail at A. This gives a full bearing on the pier, or very nearly so, and it will be found to make a much better job than the old custom of just having the narrow edge of the floor joists resting on the piers.

The facing shown at B should be from one-half to three-quarters of an inch wider than the floor joist, so that it will project a little below the pier. This gives a good place to secure the lattice work from the back side.

The top rail in the porch rail is made of two pieces, as shown at R. It is difficult to get a single piece rail large enough for this kind of a porch. Many of the built up rails consist of from six to eight pieces, which make them more or less expensive. The rail, as shown in the sketch, is designed to work in between the small single rail and the large six and eight piece rails, and will be found a very easy rail to make, an inexpensive one, and at the same time a good, serviceable rail and one that will look well. The bottom rail of this porch can be made in one or two pieces, as

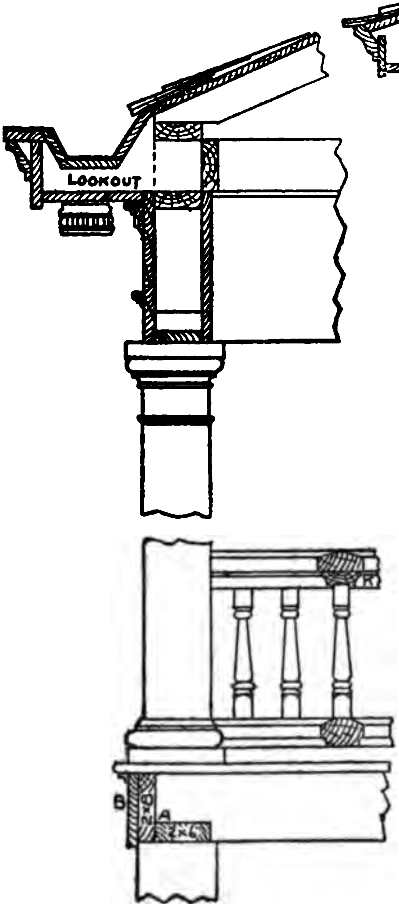


FIG. 100

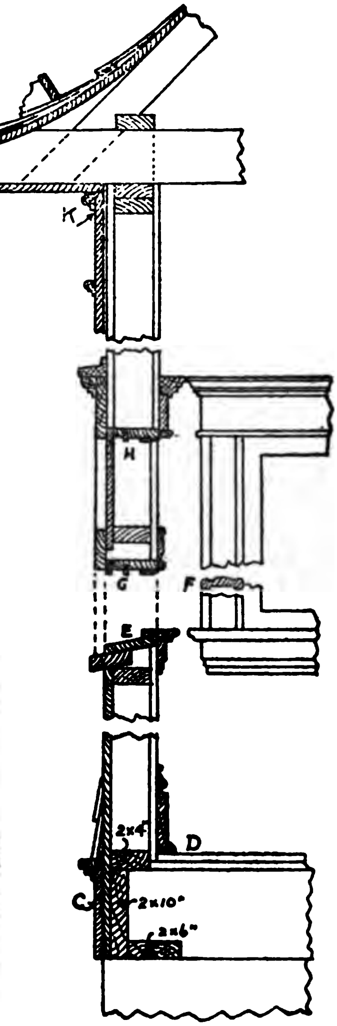


FIG. 101

desired. If made from a 4 by 6 it could easily be made in one piece. The porch has a box frieze and cornice with a sunken gutter in cornice. The cornice has a wide frieze with a band mold and a bed and dental mold. A planceer, fascia, crown mold and cap piece complete the outline of the cornice.

The gutter is formed with three pieces, a bottom and two side pieces. The side pieces are put in sloping. No gutter should be formed with perpendicular sides, making square angles in the bottom, for they are always causing trouble by freezing and bursting. Sloping sides will allow the ice to expand without any danger of injuring the gutter.

Lookouts are nailed to the ceiling joists and allowed to project in front as far as required for the cornice, and a plate spiked on top of the lookouts supports the rafters. This porch is designed for a shingle roof, but the framing of the roof is such that any pitch can be used, even to a very flat pitch for tin roof, or any kind of a flat roof it is desired to have can be applied to this construction, for the pitch can be varied to suit without in any way interfering with any other part of the design.

Fig. 101 represents a section of house framing from sill to cornice, showing the ordinary window construction. The sills in this are framed similar to the porch, but in addition have a 2 by 4 plate put on top, which laps over on the joists, as shown. The advantage of this kind of sill and framing is that it saves the time required to cut gaines in solid sills. This kind of a sill, made of a 2 by 6, 2 by 10 and a 2 by 4, requires a little more lumber than a solid 6 by 6 sill, and if well put together we consider it fully as good as the solid sill cut full of gaines for the joists. In some large cities there are building laws prohibiting this form of construction. We presume this is principally on account of making the walls more susceptible to the spreading of fire than for lack of strength. We have good reason to believe that sills made in this way, that is, well made, are fully as strong as the solid sill ordinarily put together. If the walls were bricked up inside to level with top of floor joists, then all danger of the spreading of fire is avoided, there is something to hold the buildings solid to the foundation wall, and the result cannot fail to be satisfactory in every particular.

At C in Fig. 101 is shown the outside base water table and mold. At D the double floor, base, base mold and quarter round, the ordinary base finish of the average job. At E is shown a section through the sill of an ordinary window in a frame building, the sill, subsill, stool and apron. At F is shown a section of the casing. At G is shown a section through the side jambs and casings, showing outside casing, blind stop, jamb, stops, inside casing, studding and weight box. At H is shown a section through the head, showing outside casing, cap and mold, jamb and stops, inside casing, cap trim, etc. Above this, at

K, is shown the general construction of the cornice, etc. In this the ceiling joists extend out over the building as far as required to make the cornice. A plate on top of the ceiling joists supports the rafters. The roof is concaved at the bottom by nailing on circular pieces to the bottom ends of the rafters, as shown. A standing gutter is placed on the third course of shingles on the roof. This makes a very nice finish and one much used at the present time. The porch finish and main cornice, as here shown, will work in harmony on the same house, and are well adapted to houses of the hip roof class.

Cutting Window Openings.—There are many carpenters who cannot really figure out the proper size to cut window openings. That is, how wide the space should be between studding and how high between headers. Windows are nearly always listed and sizes given glass measure, as 24 x 32, 2-light, which means that the window has two lights with glass twenty-four inches wide and thirty-two inches high. The width of the opening between studding should be ten inches wider than the width of the glass which, in this case, would be thirty-four inches between studding. The height between headers should be eleven inches more than the length of the two lights, thus two lights of thirty-two inches each will be 64 inches and eleven inches added to this will make 75 inches, or six feet and three inches. In regular two-light windows six inches is allowed for wood or sash in height, two inches top rail, one inch meeting rail and three inches for bottom rail. To this add one inch for top jamb, one inch for subsill, two inches for sill and one inch for play, which, all told, makes the eleven inches. If these figures are carefully followed no trouble in setting frames will ever occur. In large frames, such as cottage front frames, with glass 40 by 44 or approximately this size, allow eleven inches more than the width of the glass if the windows are to be hung with weights, because these windows will require extra large weights and, consequently, will require a little more room; but the average window will have plenty of room for weights when ten inches is allowed for the sash, jambs and weights.

Framing Sills.—Referring to the sketches, Fig. 102 represents a method of framing sills for light framing without gaining the joists into the sills. This method consists of using a 2 by 4 or 2 by 6 flat on the wall, and spiking a 2 by 8 or 2 by 10 on the face edge, as shown by A and B. This will allow the floor joists to be spiked through into the ends of the frame, as shown. The floor joists are to be gained on the bottom to have a good bearing on the piece A, and should be cut to fit tight against the face piece B. After these two pieces are thoroughly spiked together, then put on the third piece C and thoroughly spike the same. Allowances should be made in cutting the timbers so that they will work out right and bring the finish out flush with the wall, or as intended if otherwise shown. In most cases where houses are sheathed with seven-eighths sheathing it is best to keep the frame back one inch from the wall, so that when the sheathing is put on it will come flush with the wall, then there is nothing to project over the wall at the bottom but the outside base, as shown.

This method of framing makes a very strong frame, and if well spiked it is fully as strong as solid timbers of the same dimensions. Two 2 by 8's and one 2 by 4 are just a little more than equal in cross section to a 6 by 6, and it is safe to say that they are stronger than a 6 by 6 gained out to receive the joist. The built-up sill has much the advantage in making splices. In splicing, the joint can be so broken that when put together it will be like one continuous sill all around the building. The cut shows the sheathing, outside base, water table, siding and a double floor. Where double floors are laid the first rough

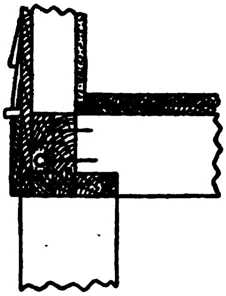


FIG. 102

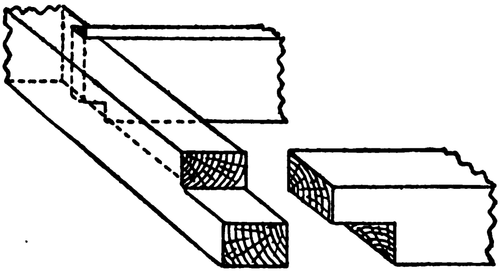


FIG. 103

floor should be laid diagonal, or stripped, before laying the finish floor. Where both floors are laid the same way the shrink of the lower, or rough floor, is often enough to cause great cracks to appear in the finish floor. This is due to the fact that the rough floor boards are usually 12 inches wide, and the finish flooring boards only about three inches wide, thus each twelve-inch board will take four of the three-inch boards, and the joint in the finish floor that comes nearly over the joint in the twelve-inch board below will draw apart very often clear out of the matching, consequently the rough floor and the finish floor should never be laid parallel, unless the rough or first floor is first stripped over the joists and the finish floor laid on top of the strips. When this is done both floors may be laid the same way without any danger of the shrinking cracks as stated above. To lay the rough floor diagonal gives a much stronger job and, as a rule, a more even floor for the finish floor.

Method of Halving Sills.—Fig. 103 shows the usual method of halving sills together at corners in framing, and of gaining floor joists into the sills as practiced in light framing. There is very little of the old-fashion mortice and tenon framing any more. Principally the timbers are just halved together and spiked into place. When floor joists are gained into sills and girders they are usually gained into the sills or girders so that the joists have a bearing of two or two and one-half inches on the sills or girders, and the depth of the gain is usually two inches less than the width of the joist it is to take, and this two inches is cut out of the joist on the lower edge to let it come flush with the sill. This may be seen at A in Fig. 103. It is often the case that girders can be set below the sills in the center of buildings and thus avoid the necessity of cutting gains in the girders. When this can be done it is better than to cut the gains, for it gives the full strength of the timber used.

Making a Good Corner.—Fig. 104 shows a simple and inexpensive way of making a good corner for ordinary house framing. Take two 2 by 4's and spike them together, as shown at A and B, and on the inside corner spike on a 2 by 2 on each side to receive the lath. This will make a good solid corner for the lathing and has less lumber in it than the way some builders make corners, and is also better than the way some are

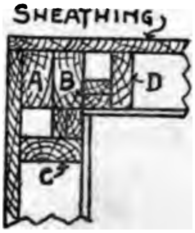


FIG. 104

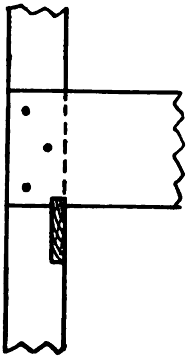


FIG. 105

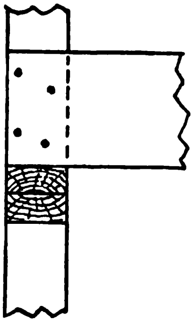


FIG. 106

constructed. The pieces C and D are only short blocks put in to make a nailing for the base in finishing. This is a matter that should never be overlooked in building a house. No mechanic can do a good job of putting down base unless there is something to nail it to. All the short blocks about a building can be utilized in a similar manner, as shown in the sketch, to make nailing places for base corners and by the sides of doors, etc.

Framing a Joist Bearer.—Fig. 105 shows the usual manner of framing a joist bearer for second floors in ordinary residences. A 1 by 4, or 1 by 6, is usually gained into the studding, and the joists are sized and notched out from one-half to three-quarters of an inch to set over it, and are then spiked to upright studding, as shown. This method is not good on heavy work and for floors that are to sustain heavy loads; it makes the bearing on the joist too small and would cause the joist and ribbon board to crush into one another to some extent if the loads placed upon them were very great.

Fig. 106 shows a better method. This method consists of putting a double plate around for the joists to rest on. The double plate makes a good bearing for the joists, one that will sustain any weight. By using the double plate it is much easier to keep the walls straight than with a ribbon board, which bends in and out at the slightest cause and is often hard to get straight, and harder still to keep straight. Then, again, the double plate serves as a first stop between stories. The double plate ought always to be used on the houses that are full two stories in height; it is far better than the ribbon board, and it will result in giving a straighter and better job all around.

Fig. 107 shows a method of framing the foot of rafters for an ordinary square, plain cornice. On the average work there is probably more of this put on than any other kind. Double plates should always be used in order to bring the plate straight, even if it is not needed otherwise. This

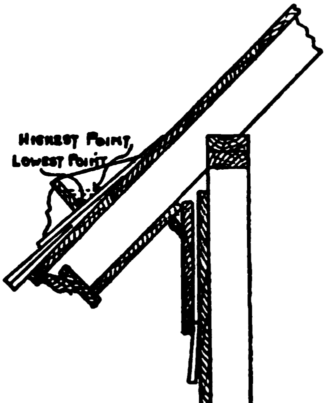


FIG. 107

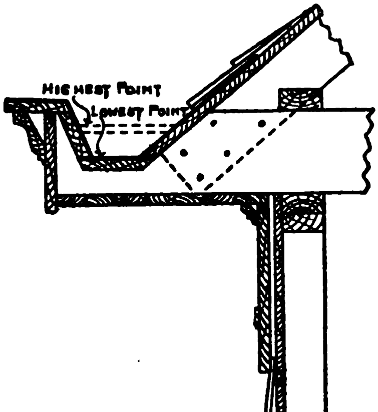


FIG. 108

cornice provides for a frieze, plancier, fascia, crown and bed mold, as shown. The standing gutter shown on the roof should be placed either on the second or third course of shingle; the second course, unless for some cause it cannot be so placed. This gutter must be lined with tin, and the tin should extend up under the shingles at least five inches. The first course of shingles starting from the gutter must be a double course, the same as starting from the bottom. The pitch in the gutter to run the water to the outlet is usually obtained by dropping the end, where the outlet is to be, down the roof a little. This is all right for short lengths, but for long runs it does not give sufficient fall to the gutters. When the fall or pitch is not enough it can be increased by putting tapering pieces in the bottom, as shown.

Fig. 108 . This is a large, square, box cornice, and is used quite extensively throughout the west, where a very wide cornice is desired, and particularly on two-story residences. The plancier is made of flooring or beaded ceiling, and can be extended out to almost any width. Usually two to two and one-half feet is about the average. A double plate is used for the joists to rest upon, and the joists extend out to support the cornice and are cut out to form the gutter, cutting them deeper and deeper toward the outlet. Care should be taken to cut them to a true grade, so as to thoroughly drain the gutter. This can be arrived at the easiest and most accurately by striking a chalk line on the ends of the joists (before the fascia is put on), from the high point to the low point. This will show the proper depth to cut each joist to have a perfect grade. Care should be taken not to let the line sag, in striking the line.

The single plate above the joists supporting the rafters can be varied a little if necessary. For example, if a narrower gutter is desired, the plate can be thrown out some, say four inches or about, but if this is done it should be remembered in cutting the rafters, for if thrown out it widens the run of the rafters, and would necessitate cutting the rafters to meet the requirements in the case.

At A is shown a band mold broken around the frieze. This is usually placed about four and one-half inches above the frieze from the bottom of the mold, so that when window frames are set with the side casings up against the frieze, the part of the frieze below the mold forms the head casing for the frame and gives it a finished appearance.

Method of Setting Studding.—It is indeed a simple thing to set studding and yet it is surprising how many mechanics, and many of them good ones, set them apparently without any thought. This causes them a good deal of bother and work, as it results in the plaster cracking in the corners.

Fig. 109 shows a corner post made out of four studding, or the center one can be made out of short pieces—almost any carpenter knows how to make one—yet apparently few know how to make one practically as good, in less time and less lumber by nailing them together.

Fig. 110 shows an easy way and would be all right if the thickness of two was the exact width

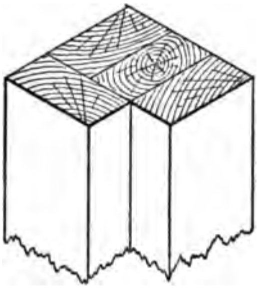


FIG. 109

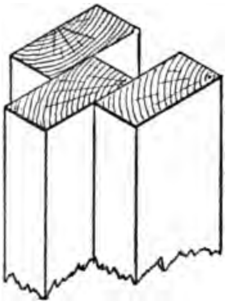


FIG. 110

of one, but many times they are not, and so it is better to nail them together, as in Fig. 111. We have made them this way for years and we consider them a very good corner.

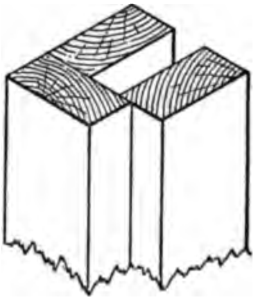


FIG. 111

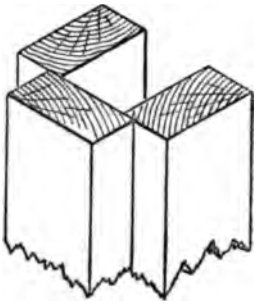


FIG. 112

Fig. 112 makes the best partition corner we know of. It is made much easier than one with blocks nailed in between two studding and then one nailed on the blocks, and my observation has been that it does not crack the plastering.

Fig. 113 is practically the same as Fig. 112. It is made for partitions which are made the flat way of the studding.

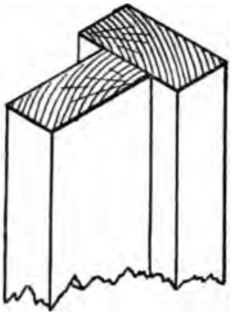


FIG. 113

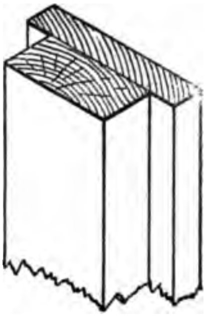


FIG. 114

Fig. 114. While it is not quite as good as the ones just mentioned, it does very nicely, especially if one is running short of studding. It is simply to nail a sheathing board on the back.

Fig. 115 carries out the same idea in double joist under partition for floors, as Fig. 114 does

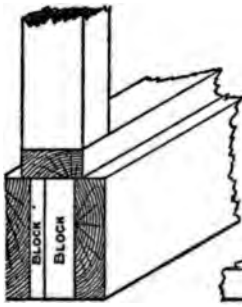


FIG. 115

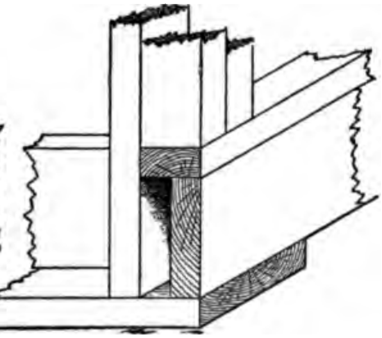


FIG. 116

for receiving the lath and plaster. This saves the necessity of nailing pieces on to the sides of the joists to receive the ends of the flooring.

If you wish to make the joists rigid this may be done by nailing three-inch blocks in between, as shown in the illustration. It is better to nail the blocks to one of the joists first and then nail the second joist to these blocks. This makes it just far enough apart to spike the studding on top in a good and substantial manner.

Fig. 116 shows a very good way to construct a corner post in connection with a box sill. Nail a studding flatwise on top of the joist at the sides of the building on which to rest the studding. Set the end joist in just enough to receive the end studding, making a good, strong and tight job.

Fig. 117 shows a very good way to make the top of the end studding by putting on a 2 by 6 for a plate. This should be set with its lower edge even with the bottom of the ceiling joists. This makes a solid angle and prevents the plaster from cracking.

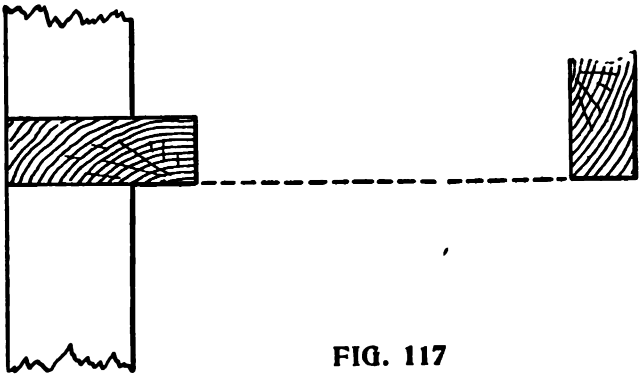


FIG. 117

Constructing a Cornice.—There is nothing that adds to the appearance of a building like the cornice. A building with beautiful walls and a good roof is indeed the kind every one should have, yet a poorly constructed cornice on that kind of a building would mar the effect of the entire building.

A cornice to be well made and look nice and pleasing to the eye does not necessarily need to always be a massive or expensive one, in fact, for some buildings it should be the reverse.

While the gutter is nearly (so to speak) out of sight, to the human eye, yet where the human eye can see it there is nothing that looks worse or entirely racks the whole human frame more than to see one standing full of water, and that kind, we are sorry to say, is only too common. Not only does the sight of that kind rack the human frame, but in time, and only too short a time, it wrecks the frame of the building as well.

Fig. 118 illustrates a simple cornice, and is, as you see, put on (where the rafter does not project beyond the plate) by simply nailing a board at top edge to the plate and rafters and let the bottom edge project, and at the gable end a board nailed one edge at center of rafter and the other edge gives the projection. Let the bottom cornice project and cut the end cornice at top edge of it and break a fascia board around the whole cornice and it makes a very good, tight and cheap cornice and answers very well for small light work, where the projection does not have to be but a few inches. Of course this kind of cornice on a large house would not do at all, but on cheap out-buildings, such as coal sheds, hen houses, etc., it answers very nicely. This kind is generally used on only those small, cheap buildings and used without gutter, although, of course, they could put a gutter on them.

Fig. 119 illustrates what is called rafter finish, and used to be railroaded through this country on all kinds of buildings, and while it was claimed to be cheap, many very expensive ones were put on with several members, molds, brackets, etc.

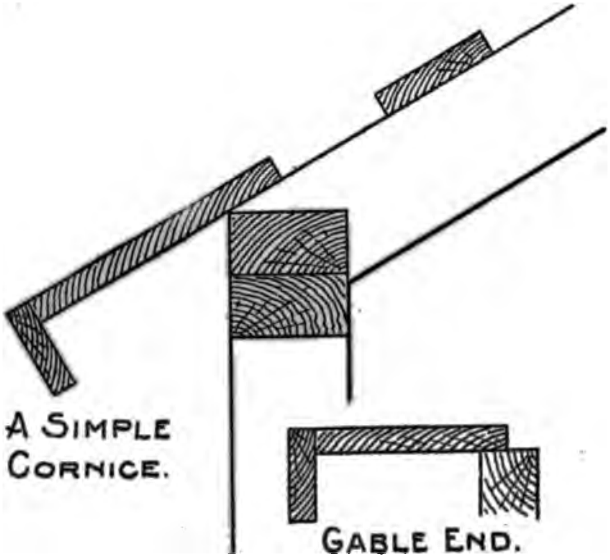


FIG. 118

We have illustrated the two ways of putting it on; the lower one is generally the best, as the drip drops over the edge of the house, while in the upper one the drip drops on the lower part of the cornice, and in a few years a nice house with expensive cornice, with molds and brackets, is all rotted away.

The main objection to the lower one is that sometimes in a big rain the water comes down the roof so fast it splashes over the gutter, and to overcome that the gutter is set at an angle between the two here shown.

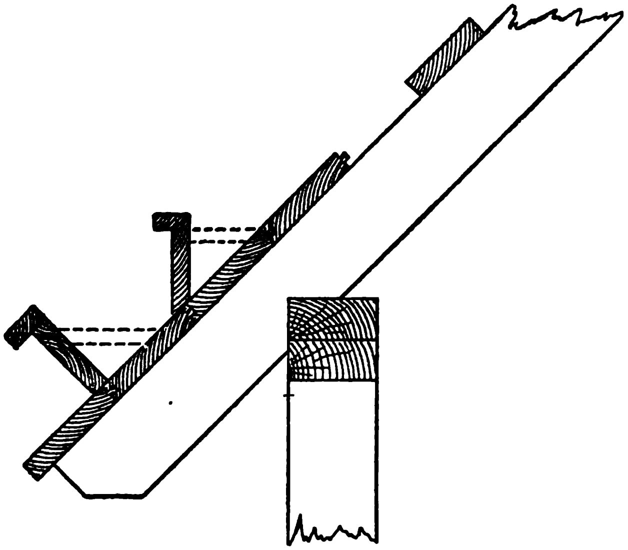


FIG. 119

The fall in these gutters is sometimes made entirely by putting one end up higher on the roof than the other, though to put them level and put a bottom board in (as dotted lines show) near the top of gutter and tapering down to nothing at the down spout makes a better appearing job; yet, for a very long gutter it is well to do both—

put one end higher than the other and put the bottom board in also.

It is much better to construct a gutter and give it all the fall you think necessary, and then add an inch more rather than make it an inch less. Give all gutters plenty of fall and you will not only be pleased, but the owner of the building will be also. These gutters are sometimes put on top of the shingles. It makes a more lasting job,

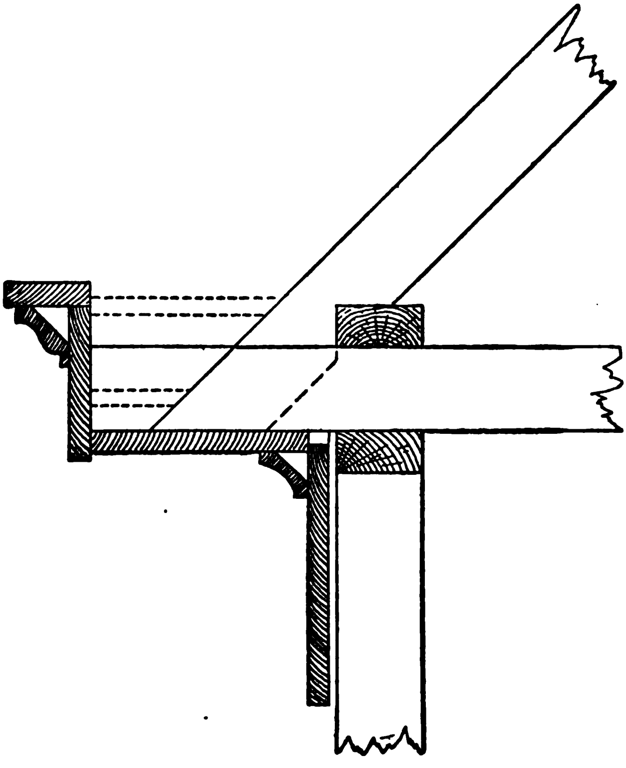


FIG. 120

but is far from ornamental, or convenient, either, when it comes to re-shingling.

Fig. 120 illustrates the real cornice and can be constructed cheaply, as illustration shows, or can be made very expensive with many members, mouldings, brackets, etc., and it will practically last forever if a good gutter is kept in it, as there is no part of it exposed.

With dotted lines we have shown both ends of the gutter board in bottom.

Cutting Openings in Frame Work.—It sometimes seems to me that there is not a trade or calling that the boy falls into as naturally as the building trade, especially carpentering. We never saw a boy but what knew something about driving nails, and quite a large per cent have at least tried to use a saw. So it comes naturally, and they easily commence to nail on a few boards, which gives them a taste, and they start in to be a builder. Step by step they move along from rough work to siding, cornice and finally to inside finish, and if they have a desire to go ahead with the work they lay it out for themselves as well as others.

They get hold of some good work on the steel square, and if they are natural mechanics they soon become a good framer. And yet as easy as it is, and as natural also, to be a good carpenter and a building foreman, it is indeed surprising to know that there is probably not one carpenter in a hundred who can cut out the openings in the frame work, and get them so that when the frames come they will fit perfectly. We have heard good foremen say the only right way was to wait until the frames came and measure them and then cut out the openings. Some sheath a house all up solid, and when the frames come they cut out, which is perhaps a sure way, but it never seemed a very pleasant, easy or cheap way. Others set the studding all up, and then before they sheath cut out for openings, claiming it is a nice way, as the studding are all evenly spaced all over the building. Some of that theory is good, but we could always cut a studding better when it was lying down level on a pair of trestles than standing plumb nailed in a building.

We always found it a much better way to lay the openings out and frame them complete before they are raised.

For a common 2 feet 8 inches by 8-foot door, get the exact height the bottom of the door should be from top of joist, then measure up 8 feet, which will give the top of door, then allow two or three inches for head jamb and space above the door. Always allow plenty of room; don't get the header so low that the lugs will have to be all cut off the jambs.

Now, as the majority of windows are the same height as doors, the measurement, when once gotten right, is good for many openings. Two inches on each side of door is generally enough, or four inches more than door measurement, is the measurement between studding, but as it is well to cut the double studding in under the header, the outside or main studding should be set about eight inches wider than the door.

Figs. 121 and 122 show it perhaps plainer than words, and also show an opening ready for a two-light 36 by 36-inch window.

A very good general rule, one easy to remember and one which works nicely on ordinary 5-inch casings, is to set the studding and headers just one foot more than glass measurement. For a house where the siding is put on the studding, in order to give room to nail and not split the ends of siding, it is well to make the opening a half or an inch wider.

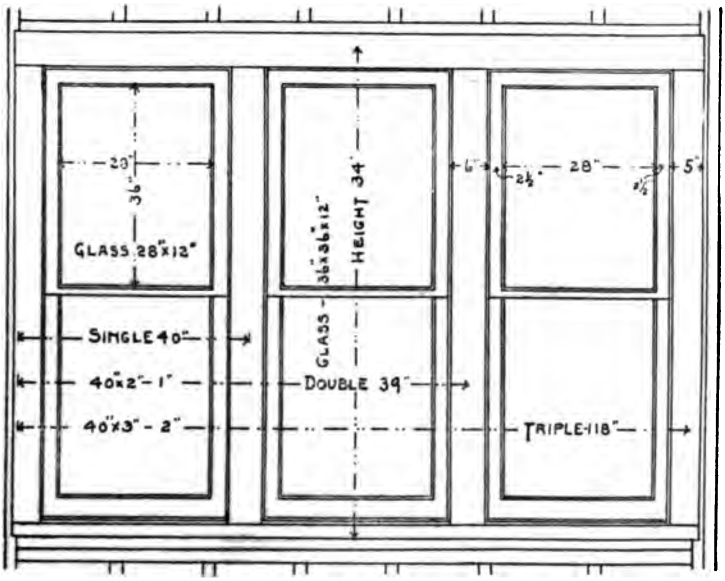


FIG. 121

The double and triple windows are the ones that seem to give the most bother; and yet it is very simple. A double window (with a seven-inch mullion) is just double what a single one is. But perhaps the most common is as illustrated, a six-inch mullion on the outside, which makes them all alike, if you wish, on the inside.

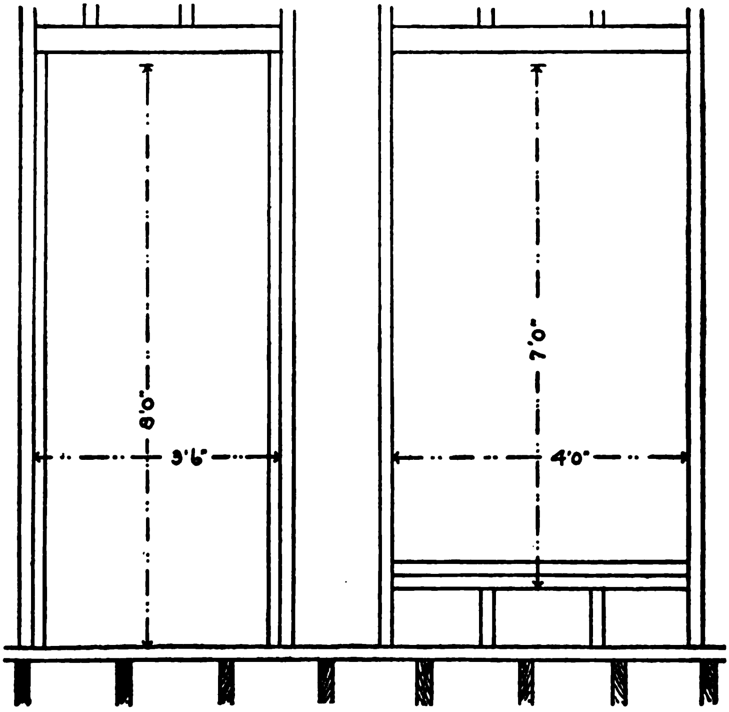


FIG. 122

We hope that a careful study of these illustrations will make it plainer to many carpenters when they go to lay out their next openings.

Affixing of Joinery Work.—Joinery work is fixed to either plugs, grounds or backings. **Plugging** is done by means of wood wedge-shaped plugs, which are driven into the vertical joints of the bricks, afterwards cut off to a level face and flush with that of the plaster, and to which the finished woodwork is secured by nailing, as shown in Fig. 123.

Grounds are used in better work, being wrought and splayed to form a key for the plaster.

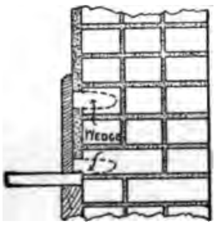


FIG. 123

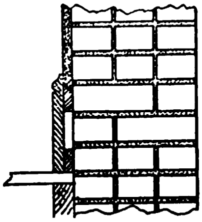


FIG. 124

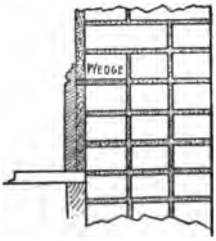


FIG. 125

They are nailed to plugs in the bross joints, as Fig. 124, or to wood pads, as shown in Fig. 125, which the brick-layer builds in the wall for the carpenter to secure his work. Metal plugs are now quite generally used in lieu of wood; they are creased and made clamp-shape, and when built into the wall they form a perfect key. The nail is driven directly into the clamp and is held more securely than if driven into wood. The cost is reduced to the minimum and, all things considered, they are really cheaper than wood. In the best class of work the grounds should be mitered at the angles, and those at door and window openings should be beveled or splayed to receive and key the plastering, and being fixed perfectly plumb or perpendicular to the plugs or other nailing, they form an excellent place to work to.

Backings are pieces of wood framed in between the studding or other work to form a solid backing for shelving, plumbing or other fixtures. Sometimes these pieces are framed in lieu of nailing, as shown in Fig. 126; but for all practical purposes this is unnecessary work, because if

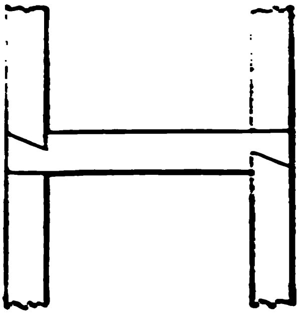


FIG. 126

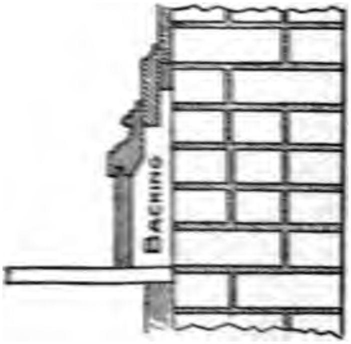


FIG. 127

properly framed and nailed will be sufficient for most any kind of work.

Shaped backings are those which are cut and notched to receive irregular framing or different members, as skirtings, etc., used in the best class of work (see Fig. 127).

All first class work should be fixed to grounds in lieu of plugs alone, which are only fit for interior work; and when the grounds are fixed per- true, vertically and horizontally, there is no difficulty in affixing the joinery without fitting, cutting and scribing; and, moreover, the plasterer finishes his work with greater accuracy, as he has perfectly true and substantial grounds to work to.

Attaching Woodwork to Stone Walls.—The cement building block industry is fast becoming a great and growing business. Almost every issue of a trade journal brings to light some new machine for the manufacture of cement building blocks or some new use for the product.

Portland cement is one of the very best building materials that has ever been produced. It is fire-proof, water-proof, strong and durable beyond all doubt when it is properly mixed and applied, and with the cheapness of it and the high price of lumber it is sure to be used in place of wood in many cases where it is practical to apply it.

For the outside walls of buildings it is a first class article when manufactured into hollow concrete building blocks. These blocks are now being made to resemble natural stone. Rock face, smooth face, tooled face or any kind of face desired can be had at a very small expense. The usefulness to which this material can be put is almost unlimited. Artistic designs of residences, stores, school houses, churches and all kinds of buildings can be executed in fine shape, giving the buildings the appearance of magnificent stone structures.

Is it durable? This is a question that will be aksed over and over again by the doubting ones. There is no question as to its durability when the article is properly mixed and applied. No better proof need be asked for than a comparison of a good cement sidewalk with one of stone, and finding the cement walk wearing and lasting better than natural stone. Sidewalks get more wear and rougher usage than stone put into a building, and a cement block that would stand in a walk would stand in ordinary building construction. Of course there might be such a thing as putting too great a weight on a building block, but this would not be likely to happen in ordinary building, and in cases where there is great weight to support it can be distributed so that the weight will not all be concentrated in a few places about the building. The crushing strength of the cement block is fully the equal of ordinary brick work and no fear of crushing need be entertained. Blocks that crumble easily indicate that the proper quantity of cement has not been used in their manufacture. For good blocks not less than one part of cement to five parts of sand and broken stone should be used. The mixture to be what is known as a 5 to 1 mixture and should be thoroughly mixed.

In some parts of the country a cement stone block building can be put up quite as cheaply as a frame building. First there is the saving in paint, for the outside wall requires no painting. Second, the blocks are hollow, producing a dry wall without furring on the inside, and plaster can be applied directly to the blocks on the inside, thus saving the furring and the lathing. Third, the blocks being uniform in size, only a very thin coat of plaster is necessary. Fourth, all the frame work, sheathing and siding is saved. Taking all these items into consideration, the cement block house can be erected nearly or quite as cheaply as the frame house.

The use of cement building blocks, where no furring is used, makes it necessary to provide some means of securing the woodwork or finish of a building, such as the window casings, baseboards, etc. It is not practical to nail the woodwork directly into the blocks, and it is doubtful if such a thing could be done. Woodwork can be nailed more or less to a brick wall, but not very successfully, and nailing finish to a cement stone block wall is something that few would care to try.

In Fig. 128 we show a wall nine inches thick, which is about the least thickness that will admit a window frame in good shape. The jamb stone at A just comes about flush on the inside of the box frame, leaving just a little for the plaster. This makes it all right for nailing the side casings on the frame, leaving just a little of the casing to reach over on the main wall and completely covering the frame box. This makes the nailing for the side casings all right. With the head casing it is different. In this case there is nothing to nail the cap trim of the frame to except at the very lower edge. And in order to get a good job of finishing some means must be provided to nail the top edge.

As the stones are made in a mold it would be very easy to put a 1 by 2-inch strip in the right position in the mold to form a recess in the lintel stone, as shown at B, in which could be driven a

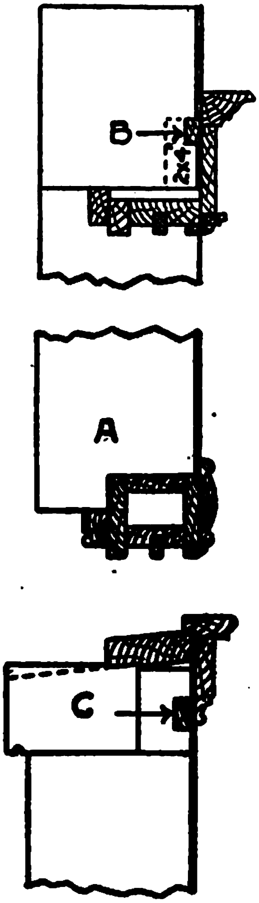


FIG. 128

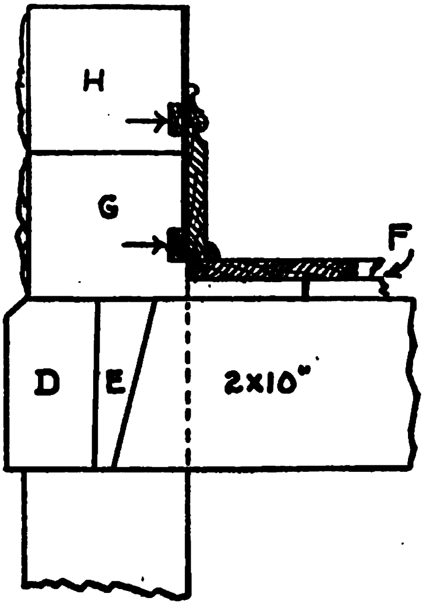


FIG. 129

1 by 2 furring strip which, if put in tight, would make a sufficient nailing for top of cap. Again, the furring strip could be molded right into the lintel when it was being made, and thus save the time of driving it in after the stone was laid. Again, the lintel stone could be molded with a recess on the lower inside edge just sufficient to take in a piece of 2 by 4, which might, perhaps, be still better, as shown by dotted lines. The window sill shown at C might be backed with a smaller stone molded with a recess to receive a 1 by 2 furring strip to make a nailing place for the bottom of the apron to the window. The stool and top part of the apron could be readily nailed to the wooden sill of the window frame.

In Fig. 129, D represents a plain bevel edge wide base course, the depth of which is the same as the joist used for the floor. E shows the backing stone, which should be made just the right size to fit in between the joists. The floor, which is double, is shown at F. Above are shown two courses of stone, G and H. These two courses are recessed at the proper height to receive furring strips to make nailing places for the base, top and bottom, as shown.

With furring strips driven into these recesses in the stone blocks, a continuous nailing strip is provided for the base, and one that ought to hold the woodwork securely in place. Woodwork cannot be attached to stone walls unless there is some means provided for securing it, and it would seem that this is a practical and inexpensive way to provide for it. We believe it to be much better than driving in wooden plugs in the mortar joints, which hold but poorly at the best. If hollow cement blocks are to be used without furring the inside of the walls, as is customary in brick and stone buildings, then it becomes absolutely necessary to devise ways and means of securing the casings, base and other finish.

Cutting in Studding.—There is a little matter of detail in building construction that has annoyed and vexed the carpenter ever since houses have been built with gables, which were plastered up the rafters from two to four feet in order to get a sufficient height to the ceiling in the center.

Every carpenter is familiar with the disagreeable job of cutting in small pieces of studding between the gable studding along up the rafter, and the difficulty experienced in nailing the small pieces. This work, on some houses, will require a large amount of time, and contractors cannot afford to put in time where it is not needed. There is a much easier way of doing this without the use of more material and with less expense to the contractor, and resulting in a much better job. With all these advantages it looks as if the carpenter or contractor ought to know better and take advantage of an easy way of doing a good job.

After the gable rafters are raised, before putting in the gable studding, cut in a piece of a 2 by 4 long enough to extend from the plate up the roof as far as the rafters will be plastered.

Put it in flat way directly under the rafter and flush with the outside of rafters, as shown by A and B in Fig. 130. By doing this all those short pieces which are required in the old way are put in at once, with only one cut to make, whereas the old way may require six to eight cuts.

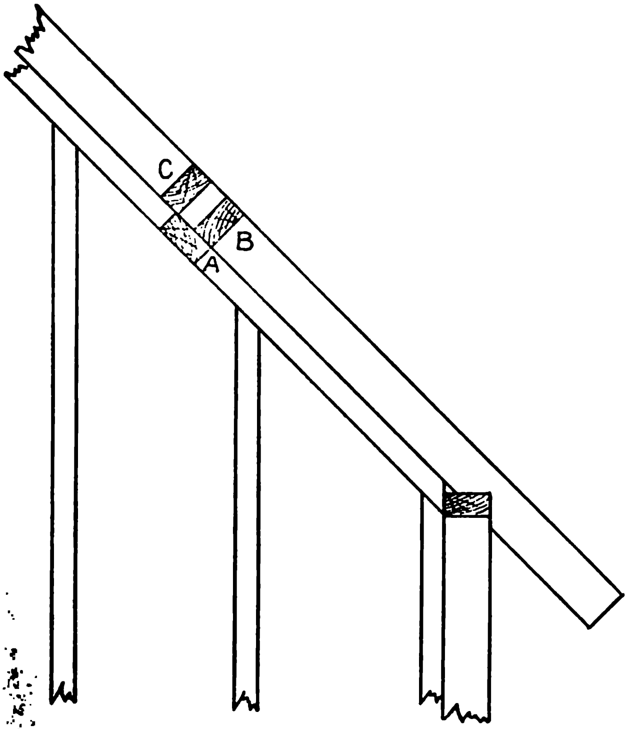


FIG. 130

After the 2 by 4, A, is put in under the rafter, then cut in the gable studding in the usual manner. At B is shown a short rafter which need extend only so far as the plastering goes, and which should be set as shown in the sketch to receive the lath that are nailed to the studding. This is not an extra piece, for by the old method it should be there just the same. The improvement is in putting in A in one piece as shown, thus doing away with a large number of small and troublesome pieces to cut and nail between the studding, along up the gable.

Putting on Cornice.—In this age of close competition, contractors cannot afford to work on a building to a disadvantage. In putting on cornice it is customary for two men to work together; this is all right so far as it goes, for one man cannot handle long boards to any advantage.

With many contractors it is the custom to work one good man and one helper, just to hold the boards while the other man does all the cutting and fitting. We do not believe this is profitable, for the reason that the man who has about all the work to do is obliged to climb and chase around from one end of a board to the other and watch every joint and corner to see that it is right. This makes it twice as hard for him and consumes much more of his time than it would if he had a man to help him who was equally as good as himself. Either man could then cut and fit a joint whenever necessary. In this way one would not be obliged to wait for the other so much. In putting on cornice one has to wait for the other more or less, but this is unavoidable.

On the average job we believe that three men working together will accomplish as much as four men working in pairs. The way to work three men is to have the man who understands the cutting best, work on the ground, making all the cuts and passing the boards up to the two men on the scaffold to nail on. The boards can be passed up and down and cut on the ground much quicker and better than they can on the scaffold. The men on the scaffold should, of course, have a saw and square and occasionally cut a board for themselves when they can just as well as not; but mainly let the man on the ground do almost all of the cutting. If he understands his business he can make nearly all the cuts right the first cut, and keep the two men on the scaffold constantly at work, and there need be but very little loss of time on account of one waiting for the other. In our opinion this way of working is far more satisfactory than the way men usually work at putting on cornice.

Part V

ROOFS AND ROOF CONSTRUCTION. Lean-to or shed roof — Saddle roof — Simple form of truss — Scissors truss — Hammer beam — Principles of roofs — King-post roofs — Flat-pitched roofs — Queen post roofs — Pressure on roofs — To find dimensions of tie-beam — To find dimensions of king-post — To find dimensions of struts — To find dimensions of the queen-post — To find dimensions of a straining beam — To find dimensions of purlins — To find dimensions of common rafters — Hip-roofs — Principles to be determined in hip-roofs — To find backing of a hip-rafter — How to find the shoulder purlin — To pierce a circular roof, Etc.

It is scarcely necessary to say that the roof of a building is that covering which is to protect the inhabitants and their property from the effects of the weather and that, in addition to this, it should be so constructed that it may shelter the walls, foundation and fabric generally from snow and rain.

Roofs are of various forms and pitches; the high pitched roofs are more generally found through the north, as they discharge the rain with greater facility and the snow lies on their surface for a much shorter time. When constructed on sound principles, the roof is one of the principal ties of a building, as it binds the exterior walls to the interior and to the partitions; while a badly designed roof will have the tendency to give way or to force the walls out of the perpendicular.

The most simple form of roof is that known as the **lean-to** or **shed roof.** This is illustrated in Fig. 131, and it derives its name from the fact that it is the roof usually used on a small annex or shed built against or leaning against the main building.

The roof most in use and also very simple in its construction is the **saddle roof** or **gable roof,** as it is often called.

This is illustrated in Fig. 132, and shows that the roof has a double slope, and the highest point where they meet is called the ridge of the roof.

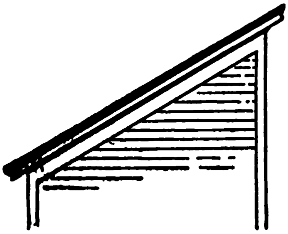


FIG. 131

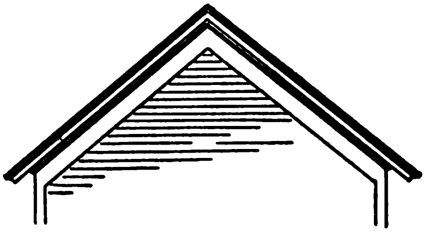


FIG. 132

Before going into the detailed construction of roofs, it will not be out of place to explain some of the principles involved in roof construction.

In Fig. 133, if AB, CB be two rafters, placed on walls A and C, and meeting in a ridge B, even by their own weight, and much more when loaded, these rafters would have a tendency to spread outwards at A and C, and to sink at B. If this tendency be constrained by a tie established betwixt A and C, and if AB, BC be perfectly rigid and the tie AC incapable of extension, B will become a fixed point. This, then, is the ordinary couple roof, in which the tie AC is a third piece of timber, and which may be used for spans of limited extent; but when the span is so great that the tie AC tends to bend downward or sag, by reason of its length, then the conditions of stability obviously become impaired. Now, if from the point B a string or tie be let down and attached to the middle D, of AC, it will evidently

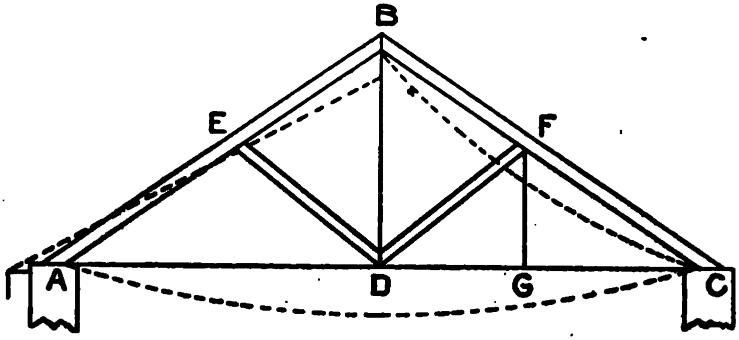


FIG. 133

be impossible for AC to bend downwards so long as AB, BC remain of the same length: D, therefore, like B, will become a fixed point, if the tie BD be incapable of extension. But the span may be increased or the size of the rafters AB, CB be diminished, until the latter also have a tendency to sag; and to prevent this, pieces DE, DF remain unaltered in length. Adopting the ordinary meaning of the verb "to truss," as expressing to tie up, we truss or tie up the point D, and the frame ABC is a trussed frame. In like manner, F being established as a fixed point, G is trussed to it.

In every trussed frame there must obviously be one series of component parts in a state of compression and the other in a state of extension. The functions of the former can only be filled by pieces which are rigid, while the place of the latter may be supplied by strings. In the diagram the pieces AB, BC are compressed, and AC, DB are extended; yet in general the tie DB is called a king post, a term which conveys an altogether wrong idea of its duties. Thus we see how the two principal rafters, by their being incapable of compression, and the tie beam by its being incapable of extension, serve, through the means of the king post, to establish a fixed point in the center of the void spanned by the roof, which prevents the rafters from bending, and serve in the establishing of other fixed points; and a combi-

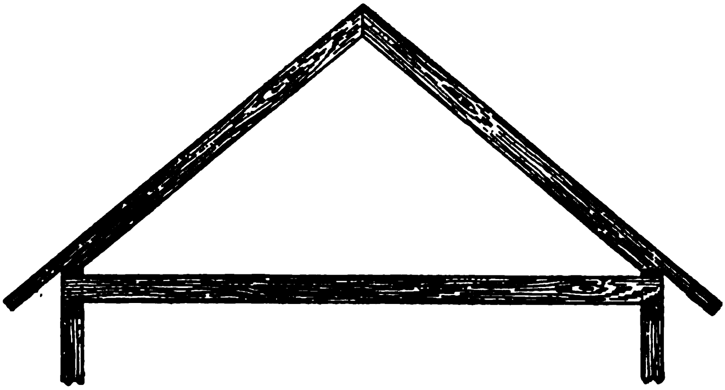


FIG. 134

nation of these pieces is called a king post roof.

The most simple form of truss is that shown in Fig. 134, and is called the common rafter—so named, we presume, because it is used in all classes of building. When it becomes necessary to add to its strength, the first thing done is to nail on a cross piece, as shown in Fig. 135, commonly called a tie or collar beam. This piece also serves as the ceiling joist where it is desired to finish a room in the attic. Some times a vertical piece is added at the center, as shown in Fig. 136. This, of course, stiffens the truss, but it does not add as much to its strength as is generally supposed. This is a common form used for one and a half story houses. The cross piece has a double purpose here; that it, to keep the side walls from spreading outwards and also forms the ceiling. It can be greatly strengthened by the addition of two extra pieces set brace shape from the center

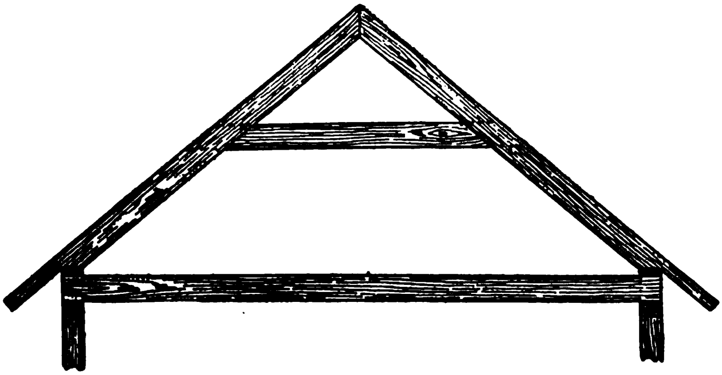


FIG. 135

of the collar beam, as shown in Fig. 137. The lower the collar beam is placed the stronger will be the truss, and should not in most cases be placed above one-third the length of the common rafter.

Another form of truss that is generally used for small church buildings is that shown in Fig. 138, commonly called scissors truss. This is suitable for a building 34 feet wide, shingle roof, and rafters set on 24-inch centers. The timbers required will be 26 feet in length for the common tie rafters and 24 feet for the collar beam. At the seat of the rafters is a 2 by 6-inch piece circled out to form a cove, as shown. This piece should be thoroughly spiked to the studding and to the side of the tie rafter and to the under edge

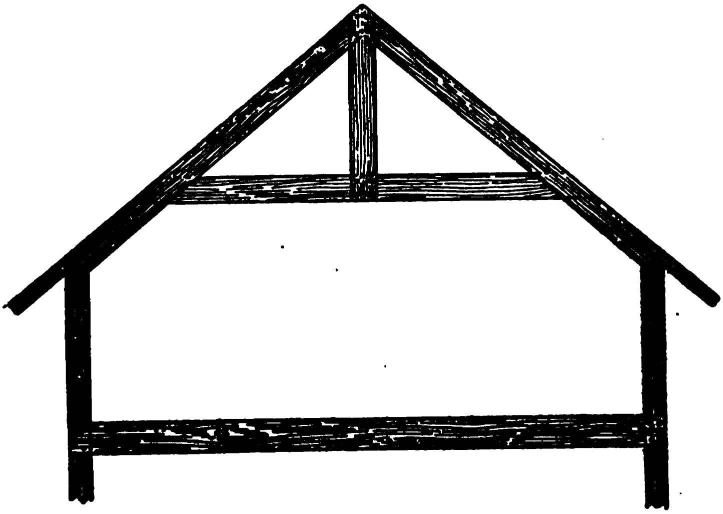


FIG. 136

of the common rafter. However, only one-third of these pieces will catch the rafters, owing to their being spaced on 24-inch centers, thus requiring the other pieces to be framed in between the rafters. Other timbers in the truss are 1 by 6-inch fencing plank. All parts should be thoroughly spiked together. Cross pieces of 2 by 2-inch stuff are used to receive the lath and plaster.

It is sometimes, however, inconvenient to have the center of the space occupied by the king post, especially where it is necessary to have apartments in the roof. In such a case recourse is had to a different manner of trussing. Two suspending posts are used, and a fourth element is introduced; namely, the straining beam a b (Fig. 139), extending between the posts. The

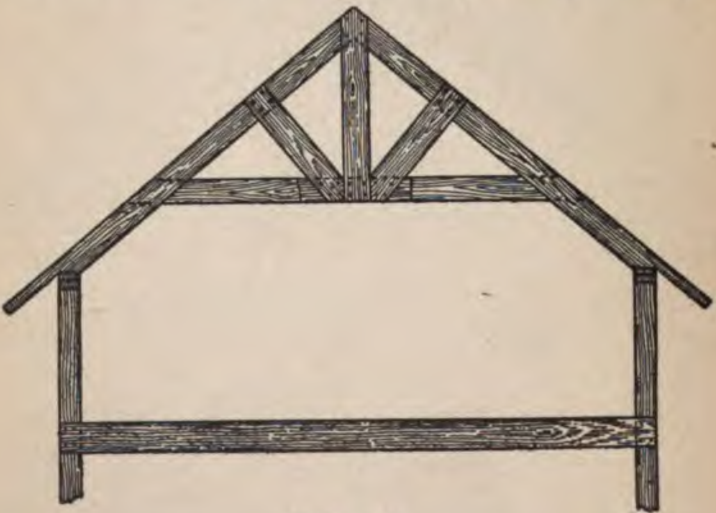


FIG. 137

principle of trussing is the same. The rafters are compressed, and the tie beam and posts, the latter now called queen posts, are in a state of tension.

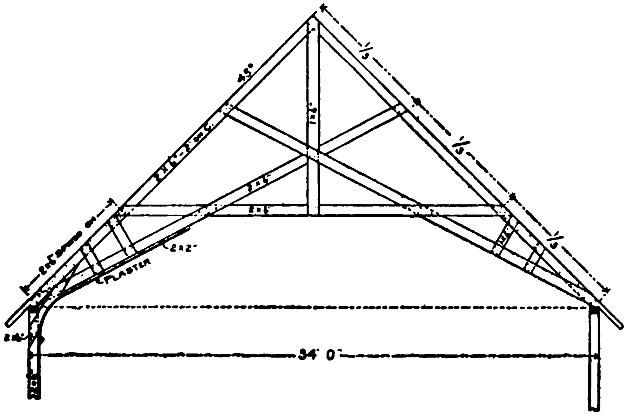


FIG. 138

In some roofs, for the sake of effect, the tie beam does not stretch across between the feet of the principals, but is interrupted. In point of fact, although occupying the place of, it does not fill the office of a tie beam, but acts merely as a bracket attached to the wall (Fig. 140). It is then called a hammer beam.

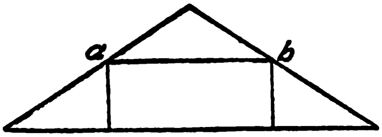


FIG. 139

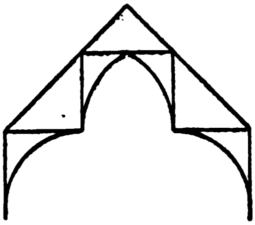


FIG. 140

The Principles of Roofs may, therefore, in respect to their construction, be divided broadly into two classes: First, those with tie beams; and second, those without tie beams.

The first class, those with tie beams, may be further classified as king post roofs and queen post roofs.

The second class may be arranged as follows:

1st. Hammer beam roofs.

2d. Curved principal roofs.

Having now given such hints regarding the principles of roof construction as will enable the workman to build any ordinary roof intelligently, we proceed to describe the methods of construction.

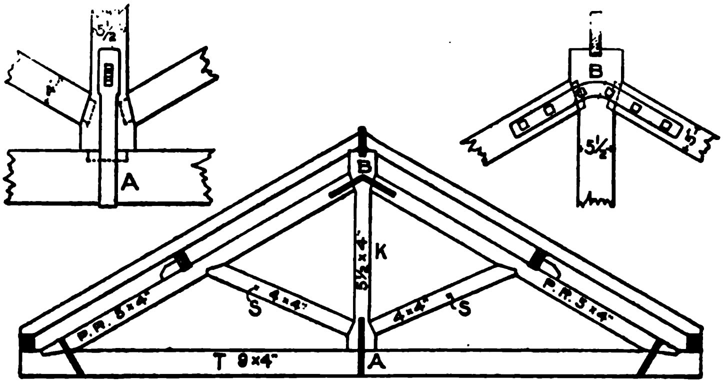


FIG. 141

King-Post Roofs.—This form of roof is practically the beginning of all trusses, which are complete framings in themselves, spanning from wall to wall, and doing duty for the cross walls, in that they support, in their turn, the ridge and purlins which require a bearing every eight or ten feet. Trusses should be no more than eight or nine feet apart and have a nine-inch bearing on each wall.

Fig. 141 represents a king-post roof truss. P R is the principal rafter, 5 inches deep and 4 inches thick; T the tie beams 9 by 4 inches; S the struts, 4 by 4 inches; and the king-post K, is 7 by 4 inches; the cuts to give a bearing for the struts are also shown.

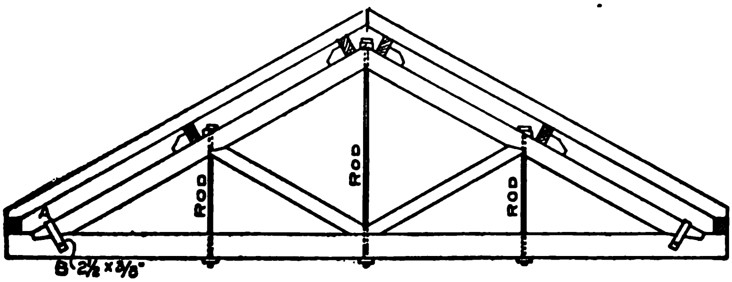


FIG. 142

Flat-Pitched Roofs are not so strong as those that are pitched higher. The nearer to the perpendicular that wood is fixed the stronger it is. This is shown by the fact that the horizontal thrust of a pair of rafters is proportionate to the length of the oblique line drawn, at right angles from the foot of the rafters, to the perpendicular dropped from the apex.

The joints of a king-post truss, in fact, all consist of mortises and tenons entering but a short distance into the timbers; and they have all beveled shoulders which ought, wherever possible, to be at right angles to the incline of the roof.

Fig. 142 is the joint between king-post and principal rafters at the apex supporting the ridge, a pair of 2½ by ⅜-inch wrought iron straps, bolted from side to side, completing the joint; or, in practice, a through-bolt from A to B will answer the same purpose though not so good. King-post trusses are suitable for spans up to thirty feet.

Queen-Post Roofs.—Queen-post trusses are used for spans over thirty feet, and contain two perpendiculars to brace up the tie beam spanning the walls.

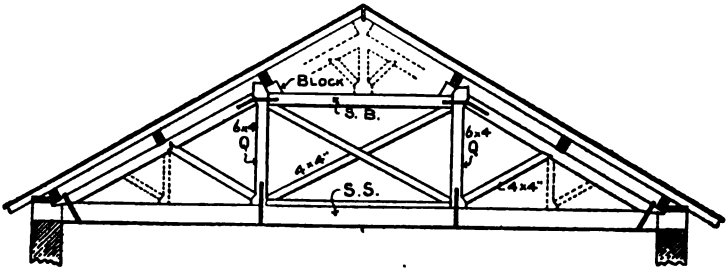


FIG. 143

Fig. 143 is a queen-post truss for a thirty-two feet span. The same form is suitable up to about forty-two feet span, and beyond that size princesses or intermediate posts and struts have to be inserted between the queens and the heels of the roof, as shown by the dotted lines; and it is sometimes necessary to frame a small king-post truss (also shown on the figure by dotted lines) above the straining beam SB, to support the ridge. SS is the straining sill and Q the queens. The other members are known by the same names as in other trusses.

A good rule to ascertain the thickness of queen post trusses is as follows: Divide the span by 8, and the quotient will be the required thickness (in inches), making up for odd parts by adding another inch for heavy-tiled roofs and omitting such fractions for slates.

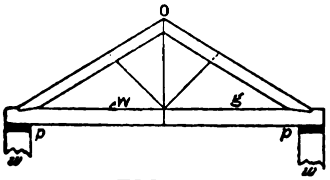


FIG. 144

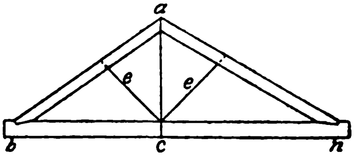


FIG. 145

Taking the tie-beam for thirty-two feet span at 11 inches deep, and principal rafters at 6 inches, by adding one inch for every five feet additional span we can arrive at their depth for the different roofs.

In Fig. 144 we show a roof that is at once strong and cheap for spans from twenty to thirty feet. pp shows the wall plates, w the wall, o the ridge and head of suspending rod; W and g show where the suspending rods may be placed if the span exceeds twenty-five feet.

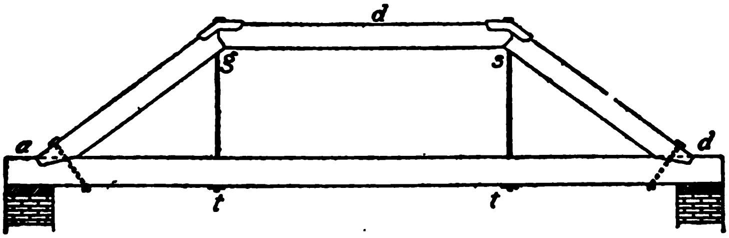


FIG. 146

Fig. 145 shows a roof with unequal sides; ac shows the suspending rod; ee may be braces of wood or rods of iron; b and n are resting points. This is suitable for a span from twenty to thirty feet.

Fig. 146 is suitable for a roof with a deck and where the span is not more than twenty-five feet. It is also suitable for a small bridge crossing a creek where the span is not more than sixteen to twenty-two feet. The deck is shown at d; gt, st show the suspending rods; ab show projections for gutters and ease-offs.

In estimating the pressure on the roof, for the purpose of apportioning the proper sizes of timber to be used, not only the weight of the timber and the slate or other covering must be taken, but also the weight of snow which, in severe climates, may be on its surface, and also the force of the wind, which we may calculate at forty pounds per superficial foot.

The weight of the covering materials and the slope of the roof, which is usually given, are contained in the following table:

MATERIAL	INCLINATION TO A FOOT	WEIGHT ON A SQUARE FOOT
Tin.	Rise 1 inch	$\frac{5}{8}$ to $1\frac{1}{4}$ lbs.
Copper.	" 1 "	1 to $1\frac{1}{2}$ lbs.
Lead	" 2 "	4 to 7 lbs.
Zinc.	" 3 "	$1\frac{3}{4}$ to 2 lbs.
Short pine shingles . . .	" 5 "	$1\frac{1}{2}$ to $2\frac{1}{2}$ lbs.
Long cypress shingles.	" 6 "	4 to 5 lbs.
Slate	" 6 "	5 to 9 lbs.

With the aid of this table, and taking into account the pressure of the wind and the weight of snow, the strength of the different parts may be calculated from the following rules, which were deduced by Mr. Tredgold, from experience; they are easy of application and useful for simple cases. Mr. Tredgold assumes 66½ lbs. as the weight on each square foot. It is customary to make the rafters, tie-beams, posts and struts all the same thickness.

To find the dimensions of the principal rafters in a king-post roof of pine timber:

Rule:—Multiply the square of the length in feet by the span in feet, and divide the product by the cube of the thickness in inches; then multiply the quotient by .96 to obtain the depth in inches.

Mr. Tredgold gives also the following rule for the rafters as more general and reliable:

Multiply the square of the span in feet by the distance between the principals in feet, and divide the product by 60 times the rise in feet; the quotient will be the area of the section of the rafter in inches.

If the rise is one-fourth of the span, multiply the span by the distance between the principals, and divide by 15 for the area of section.

When the distance between the principals is 10 feet, the area of section is two-thirds of the span.

To find the dimensions of the tie-beam, when it has to support a ceiling only.

Rule.—Divide the length of the longest unsupported part by the cube root of the breadth, and the quotient multiplied by 1.47 will give the depth in inches.

To find the dimensions of the king-post:

Rule.—Multiply the length of the post in feet by the span in feet; multiply the product by .12. which will give the area of the section of the post in inches. Divide this by the breadth for the thickness, or by the thickness for the breadth.

To find the dimensions of struts:

Rule.—Multiply the square root of the length supported, in feet, by the length of the strut in feet, and the square root of the product multiplied by .8 will give the depth; which multiplied by .6 will give the thickness.

In a Queen-Post Roof.

To find the dimensions of the principal rafters:

Rule.—Multiply the square of the length in feet by the span in feet, and divide the product by the cube of the thickness in inches; the quotient multiplied by .155 will give the depth.

To find the dimensions of the tie-beam:

Rule.—Divide the length of the longest unsupported part by the cube root of the breadth, and the quotient multiplied by 1.47 will give the depth.

To find the dimensions of the queen-posts:

Rule.—Multiply the length in feet of the post by the length in feet of that part of the tie-beam it supports: the product multiplied by .27 will give the area of the post in inches; and the breadth and thickness can be found as in the king-post. The dimensions of the struts are found as before.

To find the dimensions of a straining beam:

Rule.—Multiply the square root of the span in feet by the length of the straining beam in feet, and extract the square root of the product; multiply the result by .9, which will give the depth in inches. The beam, to have the greatest strength, should have its depth to its breadth in the ratio of 10 to 7; therefore, to find the breadth, multiply the depth by .7.

To find the dimensions of purlins:

Rule.—Multiply the cube of the length of the purlin in feet by the distance the purlins are apart in feet, and the fourth root of the product will be the depth in inches, and the depth multiplied by .6 will give the thickness.

To find the dimensions of the common rafters when they are placed 12 inches apart:

Rule.—Divide the length of bearing in feet by the cube root of the breadth in inches, and the quotient multiplied by .72 will give the depth in inches.

Beams acting as struts should not be cut into or mortised on one side, so as to cause lateral yielding.

Purlins should never be framed into the principal rafters, but should be notched. When notched they will carry nearly twice as much as when they are framed.

Purlins should be in as long pieces as possible.

Rafters laid horizontally are very good in construction and cost less than purlins and common rafters.

The ends of tie-beams should be kept with a free space around them to prevent decay.

It is an injudicious practice to give an excessive camber to the tie-beam; it should only be drawn up when deflected, as the parts come to their bearings.

The struts should always be immediately underneath that part of the rafter wheron the purlin lies.

The diagonal joints of struts should be left a little open at the inner part to allow for the shrinkage of the heads and feet of the king and queen posts.

It should be specially observed that all cranks or bends in iron ties are avoided.

And, as an important final maxim, every construction should be a little stronger than strong enough.

Hip-roofs.

The principles to be determined in a hip roof are eight, namely:

1st. Span or width of building to be roofed.
2d. Run of the building, which is one-half the span.
3d. The rise given the common rafter.
4th. The angle that the common rafter makes with the level of the plate; that is, the pitch of the roof.
5th. The length of the common rafter.

6th. The angle that the hip-rafter makes with the adjoining sides of the roof.

7th. The length of the hip-rafters.

8th. The distance from the corner of the building to the center line of the first jack; that is, the common difference.

The 1st, 2d and 3d being given the others may be found, as will be shown in the following illustrations:

Let ABCD, Fig. 147, be the plan of the roof. Draw GH parallel to the sides, AD, BC, and in the middle of the distance between them. From the points A, B, C, D, with any radius, describe the curves ab, ab, cutting the sides of the plane at a, b. From these points, with any radius, bisect the four angles of the plan at r, r, r, r, and from A, B, C, D, through the points, r, r, r, r, draw the lines of the hip rafters, AG, BG, CH, DH, cutting the ridge line, GH, in G and H, and pro-

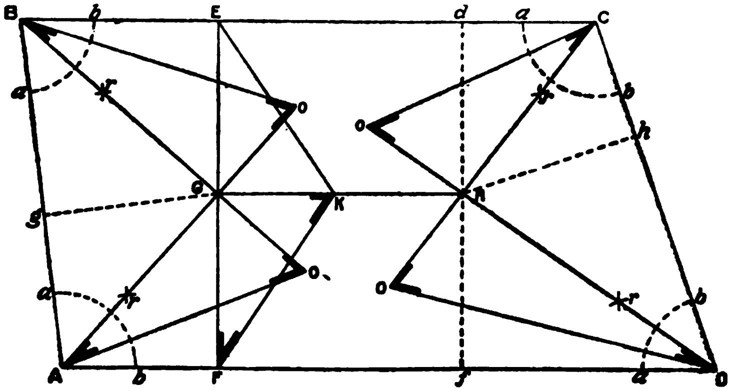


FIG. 147

duce them indefinitely. The cross lines, EF, df, are the seats of the last entire common rafters. Through point in the ridge-line, make GK equal to the height or rise of roof, and join EK, FK; then EK is the length of the common rafter. Make Go, Ho, equal to GK, the rise of the roof, and join Ao, Bo, Co, Do, for the length of the hip

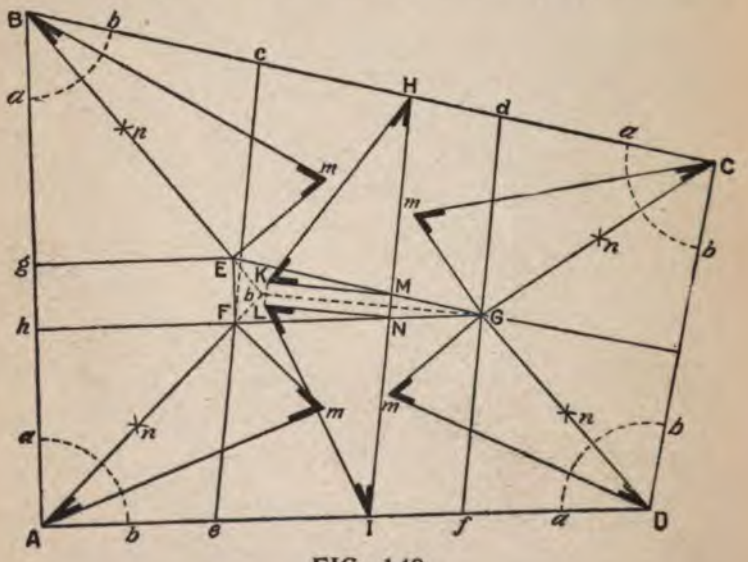


FIG. 148

rafters. If the triangles, AoG, Bog, be turned round their seats, AG, BG, until their perpendiculars are perpendicular to the plane of the plan, the points, OO, and the lines Go, Go, will coincide, and the rafters, Ao, Bo, be in their true positions.

If the roof is irregular, and it is required to keep the ridge level, we proceed as shown in Fig. 148.

Bisect the angles of the two ends by the lines Ab, Bb, CG, DG, in the same manner as in Fig. 147; and through G draw the lines GE, GF, parallel to the sides, CB, DA, respectively, cutting Ab, Bb, in E and F; join EF; then the triangle EGF, is a flat, and the remaining triangle and trapeziums are the inclined sides. Join Gb, and draw HI perpendicular to it; at the points M and N, where HI cuts the lines GE, GF, draw MK, NL perpendicular to HI, and make them equal to the rise; then draw HK, IL for the lengths of the common rafters. At E, set up Em perpendicular to BE; make it equal to MK or NL, and join Bm, for the length of the hip rafter,

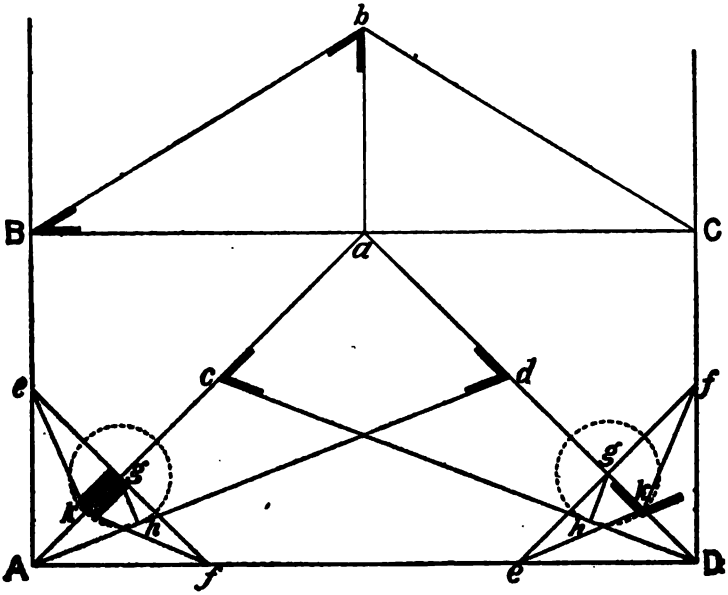


FIG. 149

and proceed in the same manner to obtain Am, Cm, Dm.

To find the backing of a hip rafter, when the plan is right-angled, we proceed as shown in Fig. 149. Let Bb, bC be the common rafters, AD the width of the roof, and AB equal to one-half the width. Bisect BC in a, and join Aa, Da. From a set off ac, ad equal to the height of the roof ab, and join Ad, Dc; then Ad, Dc are the hip rafters. To find the backing from any point h in Ad, draw the perpendicular hg, cutting Aa in g; and through g draw perpendicular to Aa the line ef, cutting

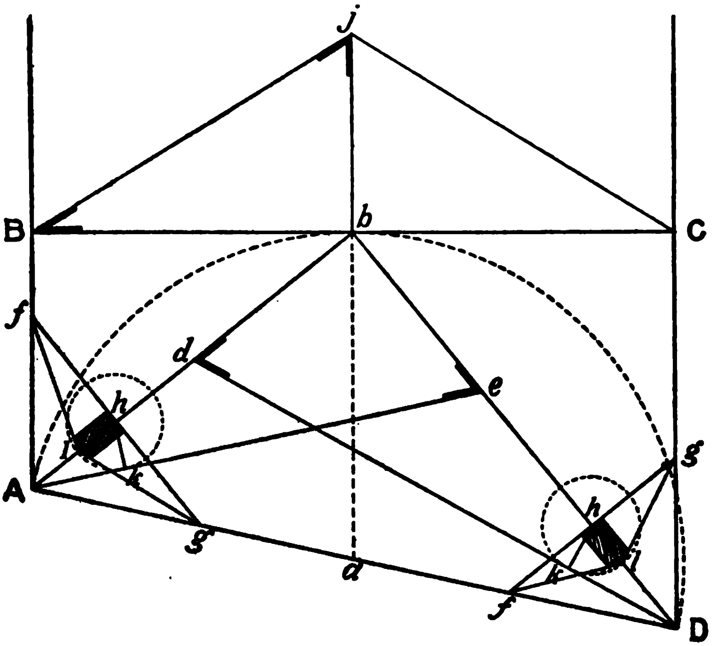


FIG. 150

AB, AD in e and f. Make gk equal to gh, and join ke, kf; and the angle ekf is the angle of the backing of the hip rafter C.

Fig. 150 shows the method of obtaining the backing of the hip where the plan is not right-angled.

Bisect AD in a, and from a describe the semicircle, AbD; draw ab parallel to the sides AB, DC, and join Ab, Db, for the seat of the hip rafters. From b set off on bA, bD, the lengths bd, be, equal to the height of the roof bc, and join Ae, Dd, for the lengths of the hip rafters. To find the backing of the rafter: In Ae, take any

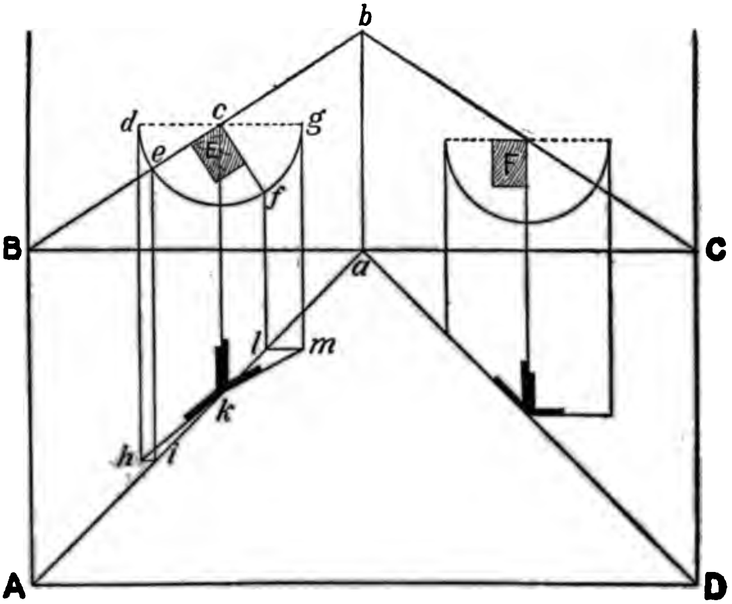


FIG. 151

point k, and draw kh perpendicular to Ae. Through h draw fhg perpendicular to Ab, meeting AB, AD, in f and g. Make hl equal to hk, and join fl gl; then fl, gl is the backing of the hip.

Fig. 151 shows **how to find the shoulder purlins:**

First, where the purlin has one of its faces in the plane of the roof, as at E. From c as a center,

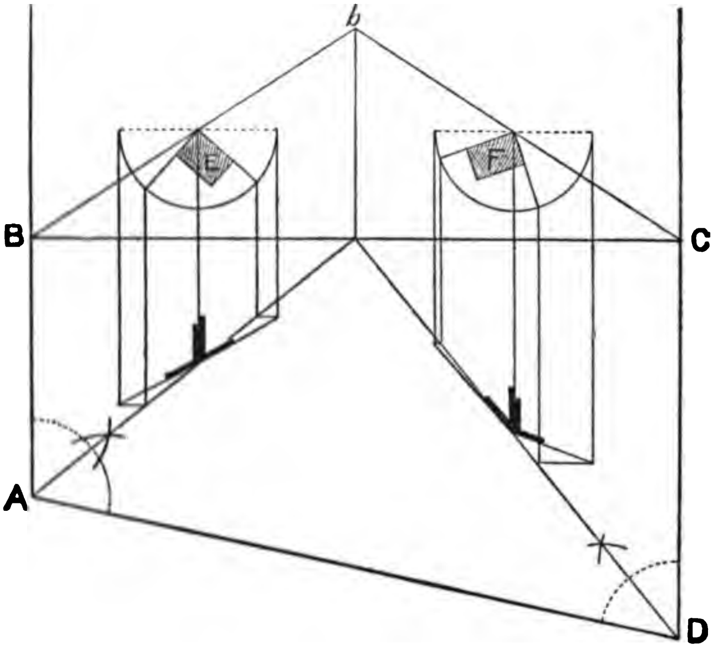


FIG. 152

with any radius, describe the arc dg; and from the opposite extremities of the diameter draw dh, gm, perpendicular to BC. From e and f, where the upper adjacent sides of the purlin produced cut the curve, draw ei, fl parallel to dh, gm; also draw ck parallel to dh. From l and i draw lm and ih parallel to BC, and join kh, km. Then ckm is the down bevel of the purlin and ckh is its side bevel.

When the purlin has two of its sides parallel to the horizon, it is worked out as shown at F. It requires no further explanation.

When the sides of the purlin make various angles with the horizon, Fig. 152 shows the application of the method.

It sometimes happens, particularly in railroad buildings, that the carpenter is called upon **to pierce a circular or conical roof with a saddle roof,** and to accomplish this economically is often the result of much labor and perplexity if a correct method is not at hand.

The following method, shown in Fig. 153, is an excellent one and will, no doubt, be found useful in cases such as mentioned:

Let DH, FM be the common rafters of the conical roof, and KL, IL the common rafters of the smaller roof—both of the same pitch. On GH set up Ge equal to ML, the height of the lesser roof, and draw ed parallel to DF, and from d draw cd perpendicular to DF. The triangle Ddc will then, by construction, be equal to the triangle KLM, and will give the seat and the length and pitch of the common rafter of the smaller roof B. Divide the lines of the seats in both figures, Dc, KM, into the same number of equal parts; and through the points of division in E, from G as center, describe the curves ca, 2g, 1f, and through those in B draw the lines 3f, 4g, Ma, parallel to the sides of the roof and inter-

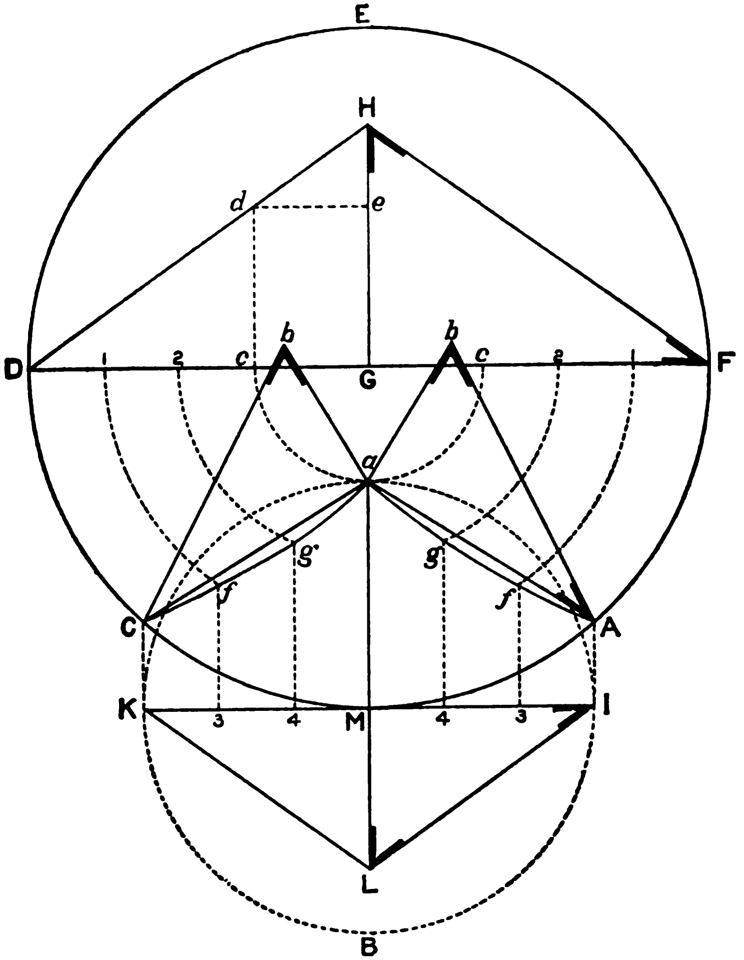


FIG. 153

secting the curves in fga. Through these points trace the curves Cfga, Afga, which give the lines of interesction of the two roofs. Then to find the valley rafters, join Ca, Aa; and on a erect the lines ab, ab perpendicular to Ca and Aa, and make them respectively equal to ML; then Cb, Ab is the length of the valley rafter.

Fig. 154 shows a section of a mansard roof with concave sides, and the manner of framing the same when it is to be erected on a brick or stone building. Pc is the wall; c the wall plate; AB the floor joist; hi is the side rafter; aie the ceiling joist; ao the top rafter; Bbd the bracket to nail cornice to; b the gutter, and ri the studding, which will be required if it is desirable to finish the roof story for sleeping rooms.

The wall plate is made of two thicknesses of two-inch plank nailed together and lap-jointed at the ends. The joints should receive the longitudinal piece h, and the ends of each should be sawed off square at or near the dotted line k. They should then be put into place, nailed to the wall plate, and the piece h should be firmly nailed to each. The lower end of the side rafters is cut out at the toe to rest on the piece h. The upper ends are also cut to receive the piece i, to which they should be firmly nailed.

If it is required to lath and plaster on the ceiling joists, they should be notched to rest on the piece i; but if the room is to remain rough, it will be as well to nail beveled pieces on each, as shown by the dotted line at s. The end of each ceiling joist should be sawed in shape to receive the moulding a, with which it is usual to finish the upper part of the roof. The top rafters may rest either on a longitudinal piece laid on the ceiling joists or on the piece i—the latter being the better method.

The curved portions of the side rafters are made separate from the straight part and are most generally formed of two thicknesses of inch stuff, first sawed the right shape and nailed together, and then spiked to the straight part of the rafter. When so much of the roof has been put up, it will be as well to mark on the end of the floor joists the proper depth for the gutter. This will be best done by holding a straight-edge on the ends of the joists, with incline sufficiently to allow water to run off, and marking on each joist the depth it will require to be cut down.

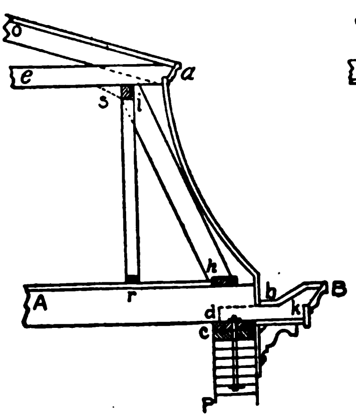


FIG. 154

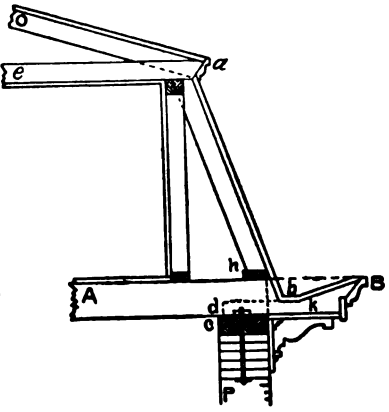


FIG. 155

The vertical part of the gutter is cut down in a line with the lower ends of the side rafters. The cornice brackets, which are cut of a shape suitable for receiving the different parts of the cornice, are made of inch stuff and are nailed to the floor joists, as shown by the dotted lines and nail-marks at dk. The best method to pursue in putting them up is to first nail one on to the joist at either extremity of the roof, then stretch a line tight between the same points on each, and nail up the intervening brackets, with the same points touching the line. If the line is tightly stretched and proper care is taken in nailing up the brackets the cornice will be perfectly straight.

In Fig. 155 we have a section of a similar roof with straight sides. The different parts are lighter than those of Fig. 154, and the construction is adapted for a balloon frame building. The letters in Fig. 155 denote the same parts as the same letters in Fig. 154, and the explanation of Fig. 154 will answer for Fig. 155 so far as the same letters are concerned. Pc is the balloon frame studding; c, a longitudinal piece for the floor joists to rest upon. The studs are cut out at the top to receive the piece c, and will thus prevent the frame from spreading.

Since there is no curve on the rafter, the face of it comes flush with the inside of the gutter. Hence the side rafters are cut out at the heel to rest on the piece h, instead of the toe, as in Fig. 154. The piece h is beveled in order that the thrust on the side rafters shall not throw the lower ends out. The inside of the gutter is also made inclining so as to give as much substance as possible between the gutter and the piece h. The remaining parts are the same as those in

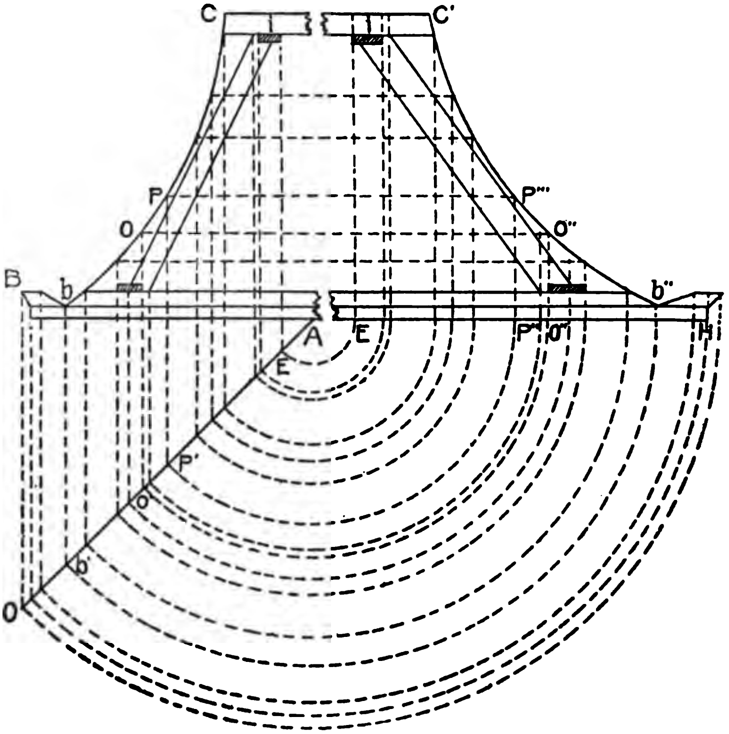


FIG. 156

Fig. 154, and the same description of those parts will answer for both cuts.

Fig. 156 shows **how to find the angle-rafter and angle-cornice bracket,** when the section as above described has been drawn. Let ABc represent the given section on the drafting board or floor. Draw the line AO at an angle of 45 degrees with AF. Then from any points C, P, O, etc., of the section as shown, draw lines perpendicular to AF, and intersecting AO.

In order to transfer the distances AE, AP, etc., on AO to AH, it is most convenient, in our small illustration, to describe arcs with A as a center; but in practice, since the distance AO will be several feet, it will be best to lay a straight edge along the line AO, and mark the points A, E, P, etc., on it; then change the position of the straightedge and lay it along AH, the point before on A being made to coincide with it again, and transfer the marks to the floor or board on the line AH at E′, P″, etc. When this has been done, draw lines from these marks and perpendicular to AH. Now draw lines from the points C, P, O, etc., on the section ABC, but parallel to FH, and intersecting the lines which are perpendicular to AH. Note the interesection of any two of these lines which are produced from the same point of the section, and this intersection will be the similar point of the angle-rafter. Perhaps the subject will be better understood if we follow the details of finding a single point of the angle-rafter; such for instance, as that corresponding to the point P of the given section. From P draw PP′ perpendicular to AF, and intersecting AO at P′. Make the distance AP″ on AH equal to AP′ on AO, either by describing an arc with A as a center and AP′ as a radius, or by transferring the point

P' to P'' on a straight-edge, as before stated. From P'' draw P'' P''' perpendicular to AII. Then from P on the section draw a line PP''' parallel to FH, until it intersects the line P'' P''' in the point P'''. This point P''' will be the point of the angle-rafter corresponding to the point P of the section. After finding all the points in a similar manner, they must be joined by the requisite curved line, and a pattern rafter cut to fit. It will be apparent from inspection that the angle bracket is found in the same manner.

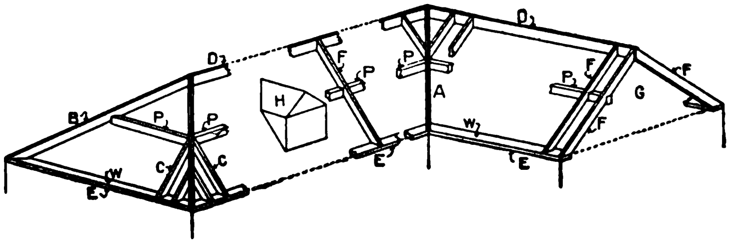


FIG. 157

Details of Roofs. Hips are the external angles by the junction of the roof and its return round the ends, where the walls are not carried up to the underside of the rake of roof to form gables.

Valleys are the converse of hips, and **jack-rafters** are the short rafters which run between the hips or valleys and the wall-plates.

Dormers are gables on a small scale, or vertical windows placed on the incline plane of the roof.

Fig. 157 illustrates a returned roof, with hips and a valley, showing generally the positions of the parts herein before described, as particularized in the accompanying reference—A, valley; B, hip; C, jack rafters; D, ridge; E, eaves; F, common rafters; G, gable; H, dormer; P, purlins; W, wall plate.

Octagonal Roofs.—Fig. 158 represents an octagonal roof. In its construction the following suggestion on laying out an octagon must be referred to.

To find the side of an octagon when the side of the square is given: Multiply the side of the

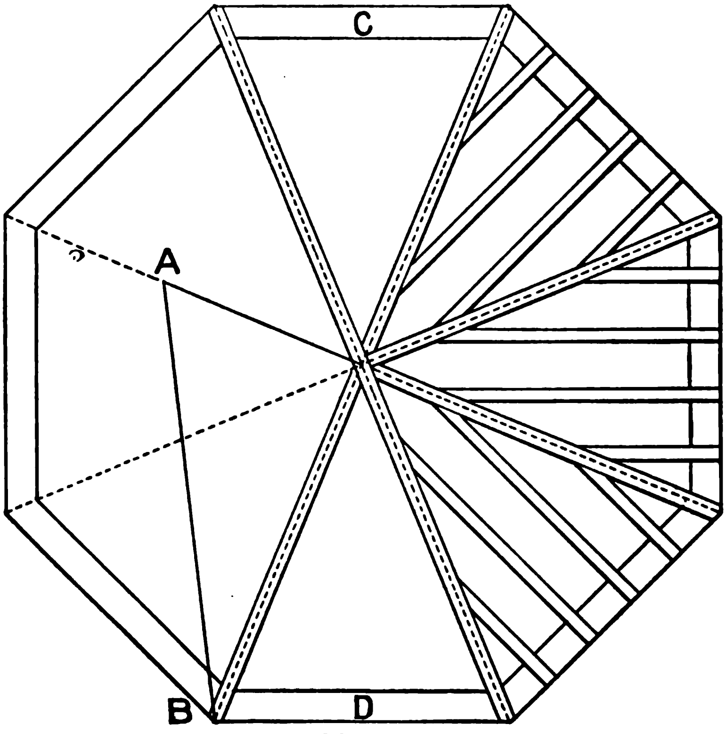


FIG. 158

square by 4.97 and divide by 12. The quotient is the side of the inscribed octagon.

To continue with an octagon roof: the length of hips is found as usual from the rise and run; the run being half the diagonal of the octagon.

Cut the first pair full length to butt against each other; the next pair are to be cut up at right angles to those, and each is to be cut shorter than the first pair by half the thickness of first pair, measured square back from the down bevel. The third and fourth pairs are to be cut shorter than the first pair by half the diagonal of a square whose side is the thickness of the first rafters. If the thickness of the first pair is 2 inches, then the third and fourth pairs are shortened by 1 and 5-12 inches, as 2 and 10-12 is the diagonal of a square whose side is 2 inches.

The first and second pairs have no side bevels; the side bevels of the third and fourth run back on both sides from the middle of the rafter. Find this bevel by taking the original length of rafter on the blade of a square and its run on the tongue, when the blade shows the cut. The backing of the hips obtain by taking 5-12 of the rise on the tongue and the length of hip on blade, the latter giving the cut; for the side of an octagon is 5-12 its square width.

Half the square width is the run of the middle jack rafter, from which and its rise we get its length. From the length deduct the same amount as from the third and fourth pairs of hips. If there are to be two jacks between the middle one and the corner, we divide the length of the side into three parts, also the rise, whence are obtained as before the distance of rafters apart, and the rise of the shortest jack. Divide half the square width of octagon by 3 to find the run of shortest jack. Just as the square is laid on to find the length of a jack, it gives the down and lower end bevels; while the side bevel is obtained by taking the length of the middle jack on blade and half one side of the octagon on the tongue; the blade giving the cut.

The following illustrations and reading matter are from Mr. Woods, and are largely self-explanatory. They show the lengths and bevels of hips and jacks of an octagonal tower

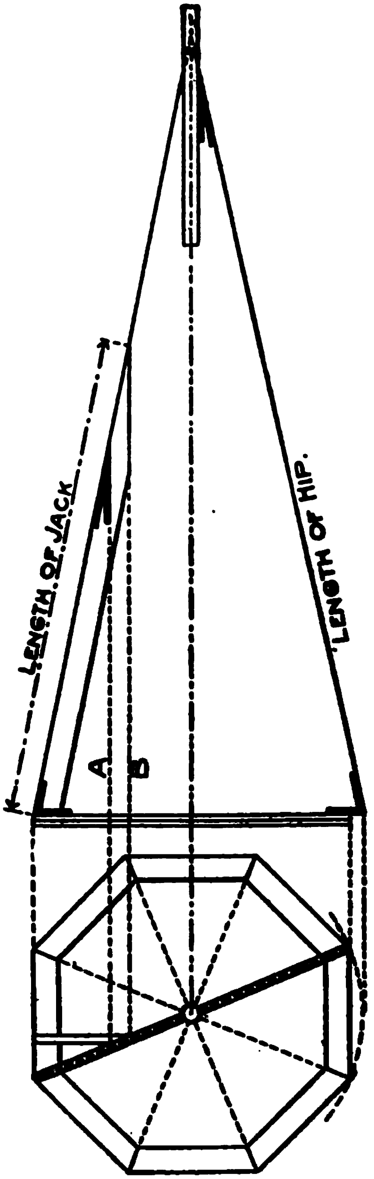


FIG. 159

roof. The seat and plumb cuts are found in the usual way of taking the proportion of the run and rise on the tongue and blade, but there must be an additional or diagonal cut across the back of the jack to fit against the hip, as shown in Fig. 159, by the dotted lines at A-B. These lines are always

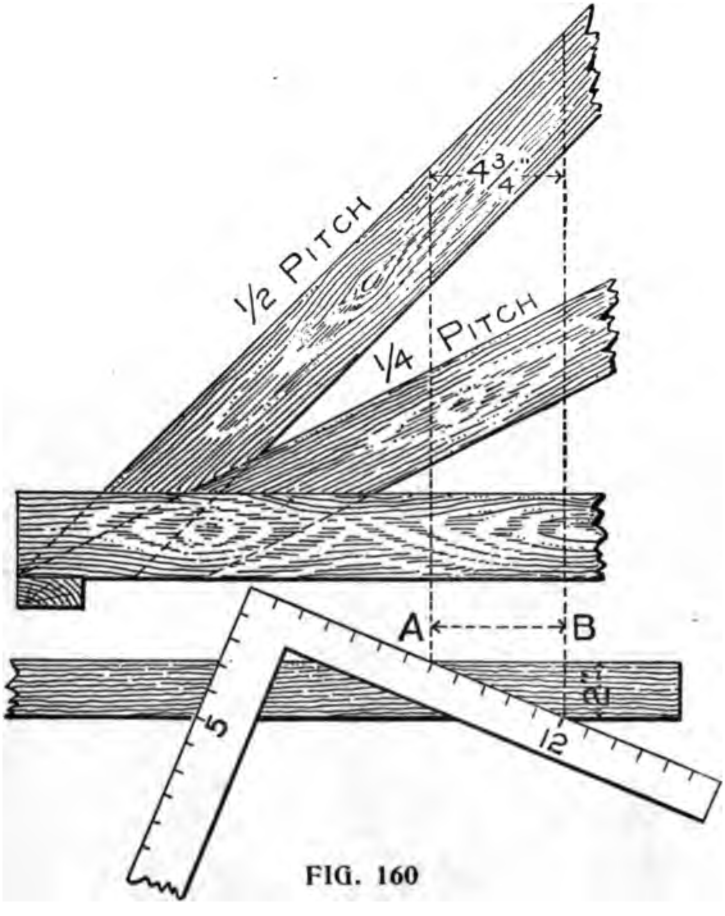


FIG. 160

vertical and the same distance apart regardless of the pitch given. The diagonal line from A to B across the back of the jack determines the angle. Fig. 160 illustrates this point. If there was no pitch at all then 5 and 12 would give the cut. These figures also give the starting lines A and B which, since the rafters are of the same thickness, will remain at right angles the same distance apart. Thus, if the rafter be 2

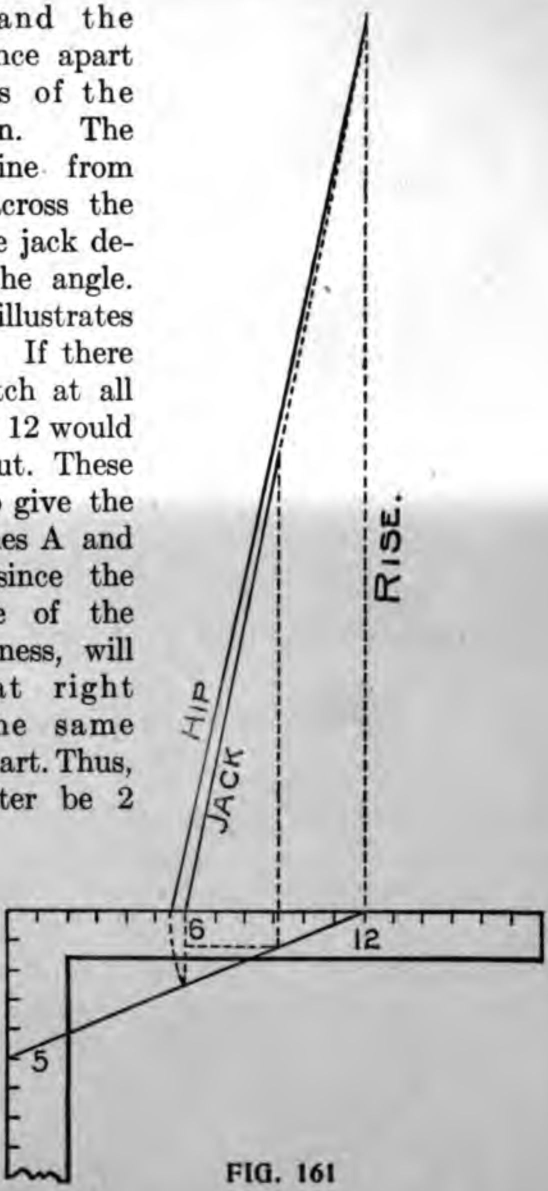


FIG. 161

inches thick, the lines A and B will be 4¾ inches apart.

The Jack Cut may be found as follows: Take 5 on the tongue and the length of the common rafter for one-foot run on the blade, the blade giving the cut. Thus it will be seen that when the principles of roof framing are understood it is not necessary to lay out an elaborate diagram.

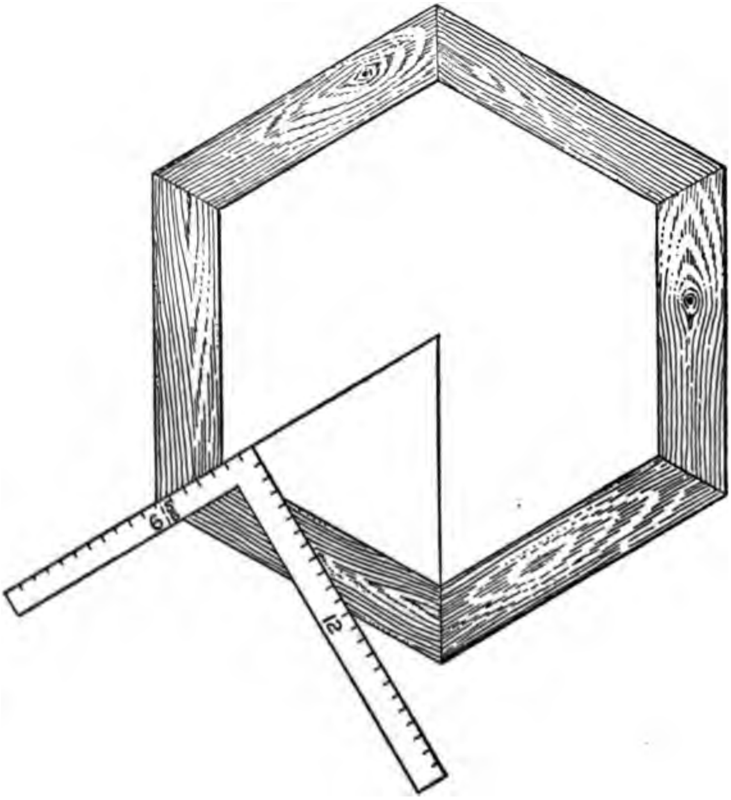


FIG. 162

A simple line drawing, like that shown in Fig. 161, illustrates all that is contained in Fig. 159.

Hexagonal Roofs.—To make a hexagon, in Fig. 162, take 6 and 15-16 on the tongue and 12 inches on the blade, and apply as shown on a base line which forms a square around the figure.

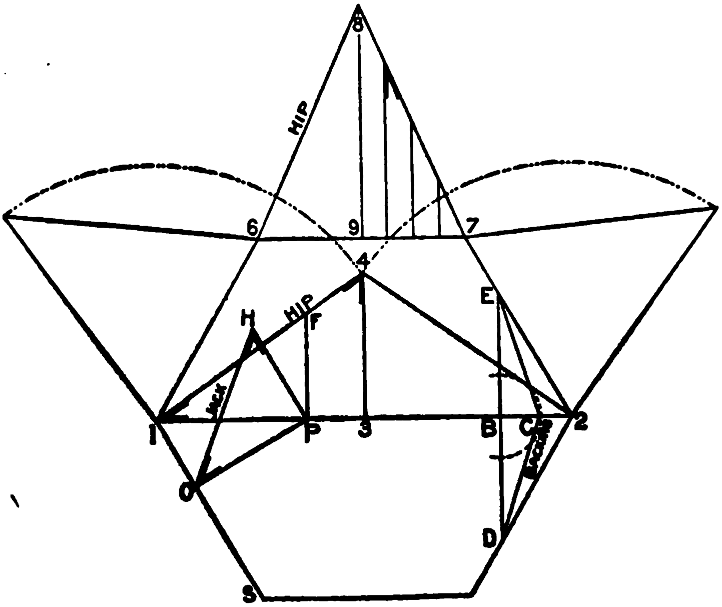


FIG. 163

The side of a hexagon equals the radius of the circumscribing circle. The square width is determined from two parallel sides; a diagonal of the figure is a line from opposite angles.

The first pair of hips are set up as in an octagonal roof. The second and third pairs have a side bevel. To find this, take half the side of the hexagon on the tongue, and half the square width added to the gain of the hip rafter in running that distance, on the blade. The tongue gives the cut. Strike the bevel across the rafter. Now, the second and third pairs are to be measured back shorter than the first pair, on their middle lines, just half the length of this bevel. The third pair has the bevel cut on both sides from the center. The backing of the hips is found by taking 7-12, the rise of the roof, on tongue, and the length of hip on blade; the latter gives the cut. The side of the hexagon is 7-12 its square width, or apothem. The lengths and bevels of the jack rafters are found as in octagonal roofs.

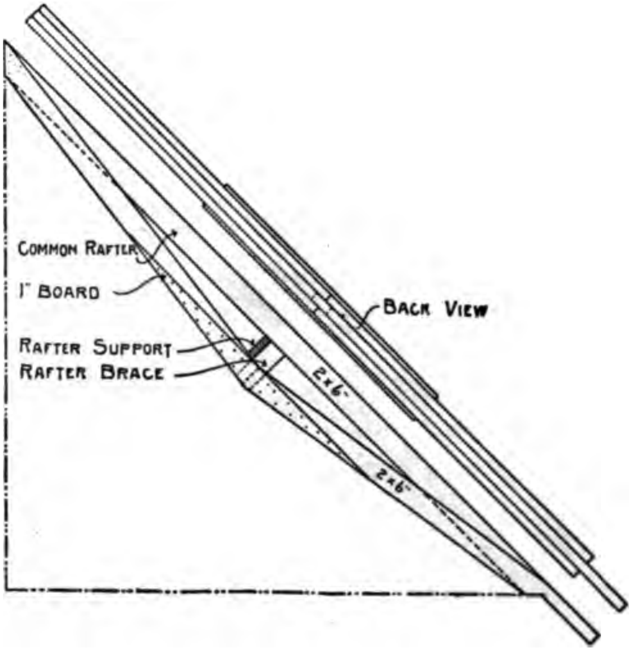
To Timber a Hexagonal Roof.—On the line1-2, Fig. 163, is the seat of the hips, 3-4 will be the rise. On the line 1-S, say at O, draw a line at right angles touching the line 1-2, which is the seat of a jack rafter. From O-P at right angles draw P-E equal to P-F, and connect OH; this gives the bevels and length for plumb cut of jack rafter. From 6-7 draw the line 8-9 indefinitely; set the compasses to 1-4, which is the length of the hip, and this length at 6 intersects 9-8 at 8; repeat from 7, which is the covering for one side of the roof, the intermediate lines being the lengths of jack rafters and bevels for side cut. On the line 1-2, say at B, take B for a center, touching the line 4-2, for radius, describe the arc BC, through B, at right angles to 1-2, draw the line DE, and from C to E and C to D will be found for backing the hips.

Part VI

QUESTIONS AND ANSWERS

A Queen Rafter and How it is Used

Question: Enclosed you will find a sketch of what we call a queen rafter. It is used for barns up to 34 feet wide without putting in purlins.



Would like to know which is the best way to support a plain roof on a square pitch barn 30 feet wide, the floor being 6½ feet below the plate.

Answer: The accompanying illustration is prepared from the sketch, and while we believe it possesses considerable merit for stiffening the roof, there is nothing in it to keep the sides of the building from spreading, as it does not form a tie, which is necessary when the loft floor is so far below the plate. We would recommend for a barn of this width (30 feet), to use 2 by 6 rafters set on 24-inch centers, and put on the sheathing diagonally toward the center close and well nailed. The center rafters where the sheathing meet should be doubled and well spiked together. The floor joist lap on to each stud and should be well nailed to prevent spreading.

Kerfing Ogee Moulding

To kerf a board one inch thick for around a circle is easily understood. But it is impossible to kerf a straight piece of ogee moulding that is to fit level around a circle. But enclosed you will find a method of working the ogee moulding, also how to kerf it after it is worked (to keep it up level).

Fig. 1 is one-fourth of a circle with a five-foot radius which the moudling is to go around. First, we take a board the desired thickness of your moulding, say one and one-fourth inches thick before it is worked out. Then with ten feet as the radius describe the arc a-b, Fig. 2, and measure in the width of your moulding, and with same radius describe another arc as c-d. Now as one-eighth of the circumference of a circle with a ten-foot radius is equal to one-fourth of the circumference of a circle with a five-foot radius, you will notice in Fig. 2 that only one-eighth of the circle is taken, allowing a few inches for cutting away of kerfs. You are now ready to make it in the shape of ogee, but this will not yet fit

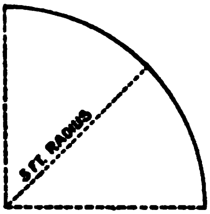


FIG. 1.

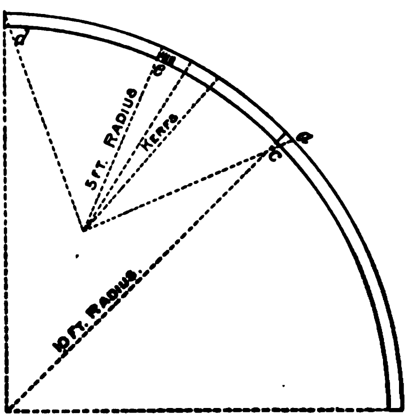


FIG. 2.

around the curve; you must kerf it first. Now with five feet as a radius, as shown in Fig. 2 from e to f, with f as a center, let all the kerfs radiate from it, as shown in Fig. 2 in the sketch. All this being done, it is best to steam it before bending it.

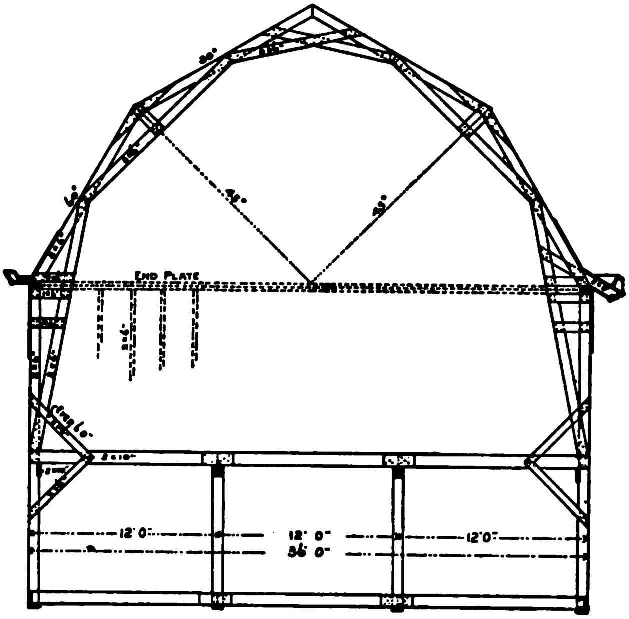
Adding One-Half Story

Question: Which would be the best way to raise a house from one story to a story and a half? The roof is a good one and do not care to take it off. Simply to cut nails under plate and raise the rafters with plate to the required height, then put studding under the required length. The house is built like a T.

Answer: It would be better to cut the studding off about one foot below the plate, then raise the roof and splice the studding. The piece of studding left hanging to the plate can be nailed to the spliced piece which should run up to the plate. This would be much easier than to cut the nails as referred to, besides there is no way of getting at the plate to securely renail it to the new studding.

How to Support a Gambrel Roof

Question: I would like to know which is the best way to support a gambrel roof on a barn



36 feet wide and posts 20 feet high. The floor being 11 feet below the plate. Please give sketch of same.

Answer: The space from floor to plate being 11 feet, will require extra strong bracing. Would recommend using 6-inch studding set on 24-inch centers and brace as shown in the illustration. The rafters to set directly over the studding and braced to same. The floor joist should be tied to each other, either by letting them lap, or by nailing a board on the side. All parts should be framed accurately and well nailed.

How to Lay Out a Gothic Ceiling

Question: Enclosed find a sketch of a Gothic ceiling over a pulpit in a church 12 feet wide and 8 feet in depth. There will be two hips, seven main arch rafters and many cripples.

Will you give a rule for finding the shape of the hip, also the shape and length of the cripples?

Answer: In Fig. 1 is shown the plan. This simply shows the number of rafters contained in the roof and would show the same for ogee or any other shaped rafters or for any pitch given the rafter.

In Fig. 2 is shown an elevation of the Gothic. This should be laid out full size on a level surface or floor—though it is only necessary to draw one-half of this diagram, as that part enclosed by A-B-C. Then A-B will be the shape of the main or common rafters. Now the cripples, or jacks, are simply a part of the common rafter and their

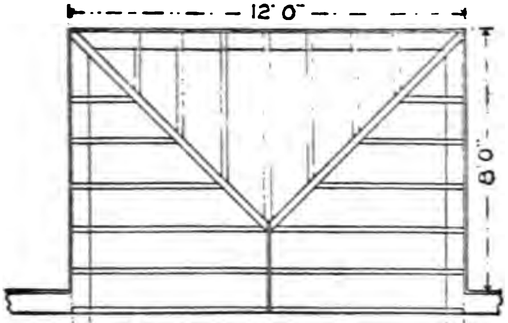


FIG. 1. PLAN.

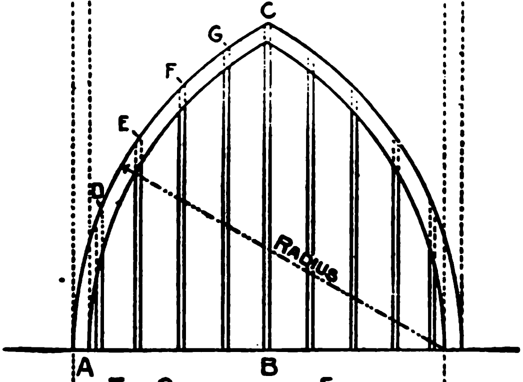


FIG. 2. ELEVATION.

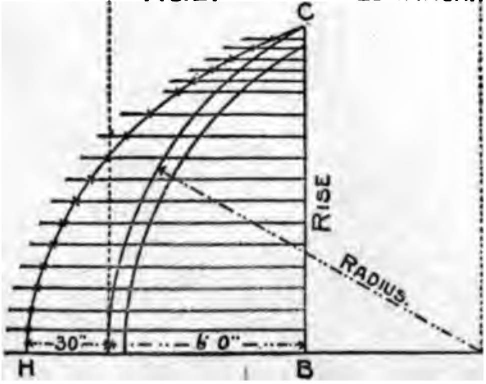


FIG. 3. DEVELOPING THE HIP.

lengths are as from A to D for the first jack, A to E for the second, and continue on to the line C-B, which is a common rafter and consequently is the same as A-C. The dotted lines across the side of the common rafter represent the distance apart the plumb lines will be for the side cut of the jack, which in the case of a square corner is the width of the jack. In Fig. 3 is shown how to find the corresponding shape for the hip. In this the common rafter is shown the same as in Fig. 2. Lay off any number of parallel lines extending beyond the curve of the rafter as shown. Now measure the length of these lines from the rise to the curve and add 5-12 to that length. In other words, the first or bottom line is 6 feet long, to this add 5 inches for each foot, or 30 inches to the line beyond the curve and check. Proceed in like manner for all of the lines, adding 5 inches for each foot and 5-12 of an inch for each inch. After all these lines have been thus measured, draw an off-hand curve through the checks and this will be the shape of the hip.

Constructing a Circular Porch

The method shown herewith, I have used for several years. It looks better than the mitered seam, is perhaps as good and is cheaper.

In Fig. 1 A is a 4 by 6-inch timber, which gives a good bearing for the ends of the flooring boards. B shows the method of finishing the floor where steps come on the circle.

Opening C in Fig. 2 shows how the heels of the ceiling joists are put in to give support for the heels of the rafters.

F in Fig. 2 shows the method I use for putting a ceiling planceer on a quarter circle porch.

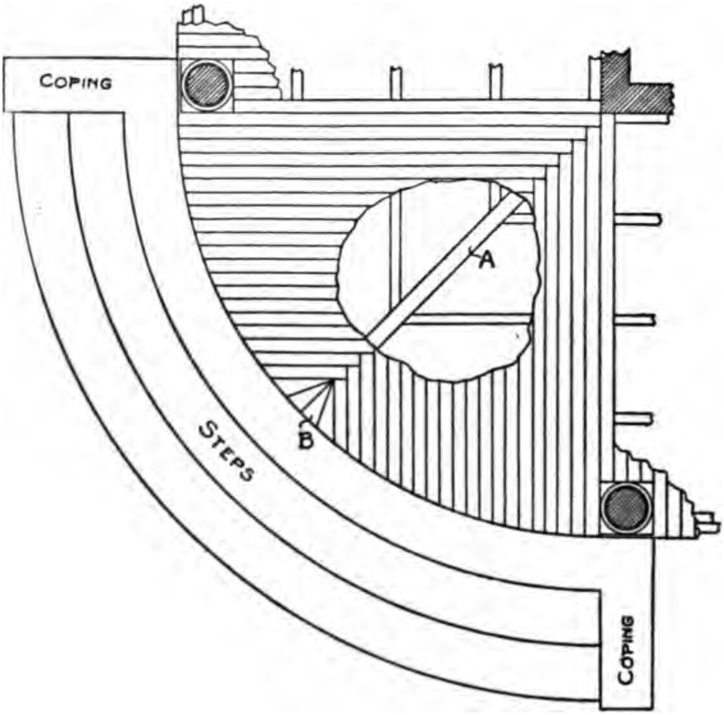


FIG. 1

D shows cripples fitted in between the joists to which the ends of the ceiling boards are nailed. I put the planceer on and saw to the circle afterwards as shown at G.

The ends of the ceiling boards are pared with a gouge to match the boards running the other way. E shows a neat way to make a ceiling.

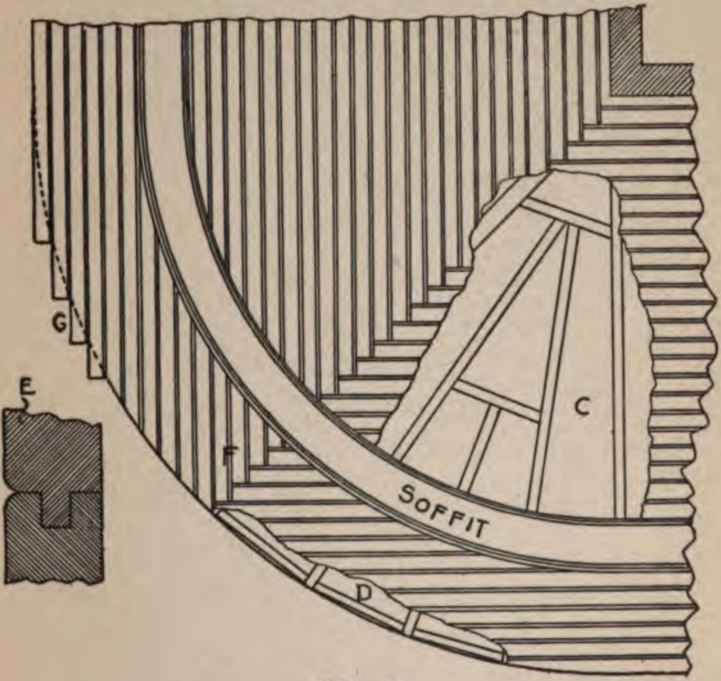
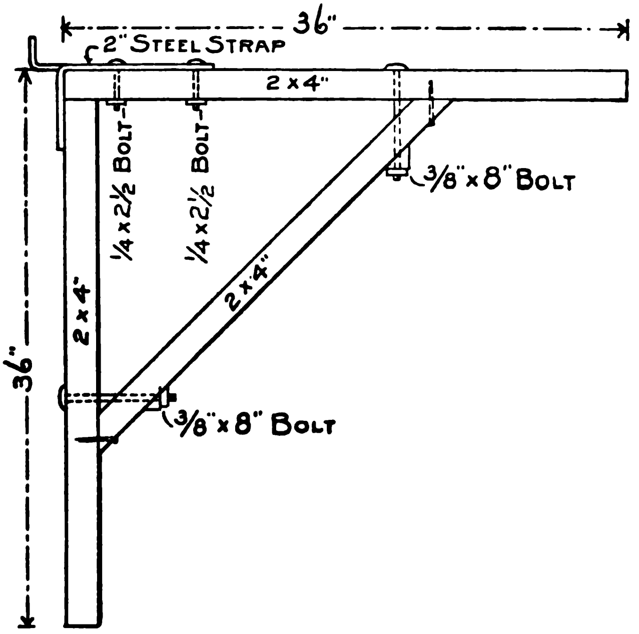


FIG. 2

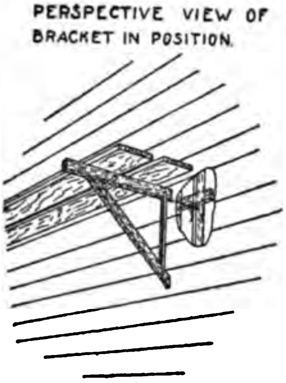
Making Scaffold Brackets

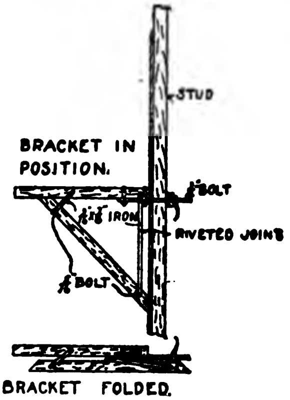
We show herewith a sketch of a scaffold bracket. The arms and brace are made of 2 by 4-inch surfaced white pine. The brace is nailed to the arms and is also fastened to same by a bolt ⅜ of an inch by 8 inches. There is a piece of a wagon tire one foot long bolted with two bolts ¼-inch by 2½ inches to the 2 by 4-inch with a rounded hook on the end which extends ⅞ of an inch beyond the corner and 2 inches up. There is a piece of iron $\frac{1}{8}$ by $\frac{7}{8}$ of an inch and 4 inches long nailed on the sides of each arm where they come together. This helps to strengthen it.



Making a Scaffold Bracket

We show herewith a sketch of a folding bracket. The arm is made of 2 by 3-inch hard wood. The brace is four feet and one inch long and takes up very little space when folded. It is easy to move from one job to another, which is a great convenience.

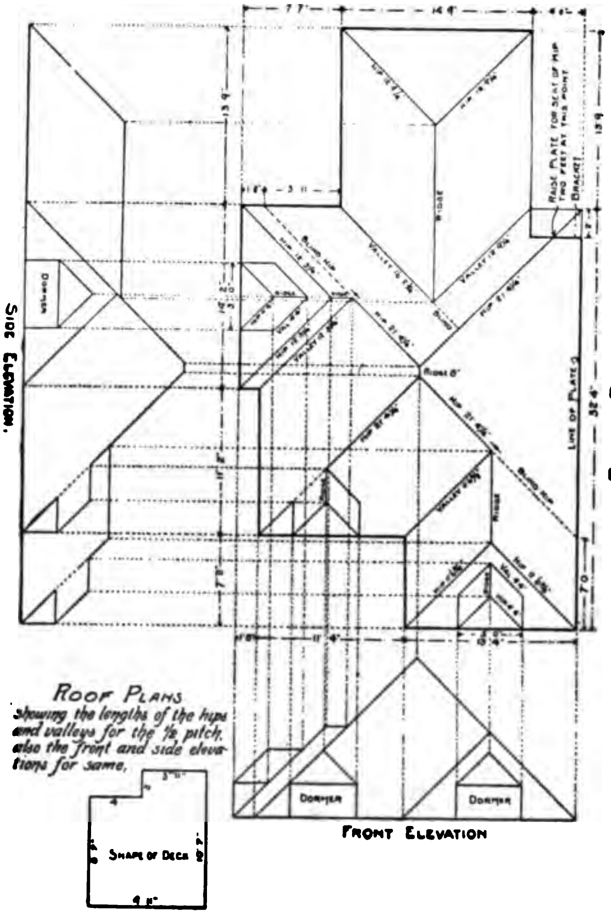




One-half Pitch Roof

I beg the privilege of submitting the enclosed drawing of the outline of a building, for which I would like to have the roof plan, or elevation for same. The roof to have one-half pitch, and hips with dormer windows in preference to gables, if possible. The building is two-story of brick, and to have shingle roof.

Answer:—While this roof is considerably cut up, there is nothing complicated about it, except at the four-foot angle on the right-hand side, which should have been opposite the angle on the left-hand side, but in this there is two feet difference. Now since the question asked for a given pitch, there are two ways to get around this irregularity. First—To make a deck, which should be placed on a level with the ridge of the highest gable and would be to the contour of the plates for the main roof and to the dimensions as shown in the small diagram. Second—To extend the toe of the right hip over the plate till it rests in line with that on the left side. Consequently the real seat of the hip will have to be raised

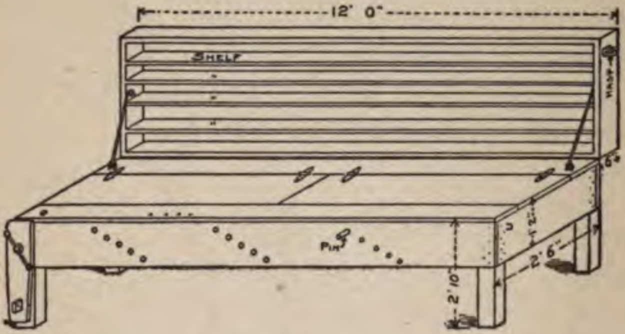


Roof Plans showing the lengths of the hips and valleys for the ½ pitch, also the front and side elevations for same,

above the plate as much as the common rafter rises, in a two-foot run, which in this case, the roof being the one-half pitch the common rafter will rise two feet at the point where marked by the arrow. The planceer at this angle will be two feet wider than that for the regular cornice, but by placing a bracket at the corner it will relieve the wide projection. By squaring up this angle, we find the largest square contained in the roof to be twenty-four feet eight inches by twenty-five feet four inches, a difference of eight inches in the length and width and this difference will be the length of the main ridge. In the plan, we show all of the lengths for the hips and valleys, but it must be remembered that these lengths are based on the supposition that the angles of the building are true, or square, with each other. If not, then the irregularity is bound to show up in the framing of the rafters. These lengths are estimated to a center line as at the center of the ridge tree. In connection with the plan, we show a front and a side elevation and by tracing the dotted lines from the plan to the elevations, the locations of the roof lines in the plan are shown in position in the elevations and need no further explanation.

Making a Tool Chest

I send you herewith a sketch of my tool chest and work-bench combined. It is the most useful and handiest I ever had. It is 12 feet long, 2 feet 6 inches wide and 2 feet 10 inches up to cover, which is 6 inches high and divided into shelves as shown. The sides and ends are covered with flooring to a depth of 1 foot 2 inches, with the front reinforced back of the pin holes. The bottoms of the chests are made of flooring and to the full depth of the sides. I have them divided into compartments to suit the tools. The top of bench is of 1-inch select lumber. The cover is of ½-inch lumber and covered with galvanized iron and hinged to bench with heavy strap hinges. A hasp and staple is provided at each end so that the cover can be locked with padlocks.



Finishing White Pine

Question:—I am building a kitchen cabinet of Georgia and White pine. We would like it a little darker, something on the order of light cherry. How would you finish it?

Answer:—The wood should be first given a coat of cherry oil stain, such as can be bought at any paint dealer's, thinning with turpentine if necessary. Then give a coat of thin shellac and finally give two additional coats of a first-class interior varnish. If a dull finish is desired, the simplest method would be to use one of the dull drying varnishes as a last coat. Another method would be to give the wood a thin coat of grain alcohol shellac and finish with two additional coats of any of the varnish stains made with aniline color, extensively advertised by many of the varnish manufacturers under fancy trade names. These dry so quickly that great care is needed in applying them to broad surfaces, like large panels, but most of them would give good results on a piece of furniture such as is mentioned.

Cutting Siding for a Gable

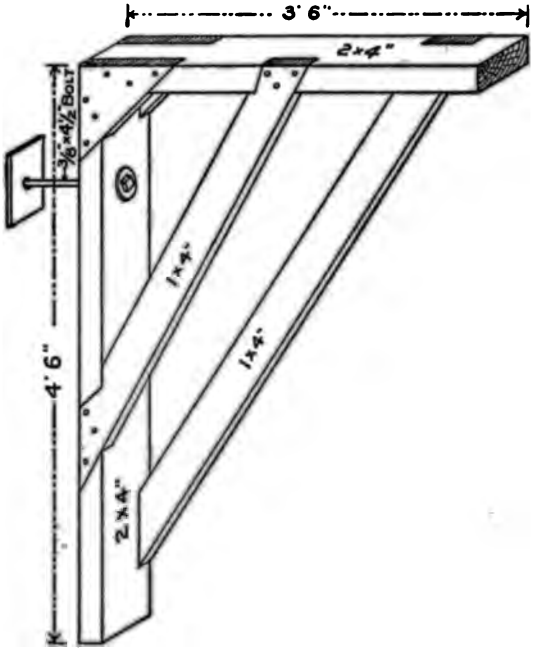
How many of you ever tried cutting the siding for a gable on the ground, instead of on the tresses? It is much easier, quicker, more saving of siding and much more satisfactory every way than to cut it out on the scaffold. As soon as you are well onto the gable fit in a piece to run clear across the gable if possible. Now be sure and cut this piece to fit neatly, as it is your pattern. Now take this to your tresses and with your working gauge lay off what you want to show to the weather. Gauge all your timber for the gable this way. Now lay the piece already cut on the next piece to be cut with the gauge line at the bottom of the piece to be cut just as it will appear when put up and mark the length. Now lay your pattern on top of the piece to be cut and mark your angles same as pattern. Don't use your bevel square, for if the siding is not exactly straight your bevels will be wrong. Now proceed in like manner until all are cut; then all you need to take to the scaffold is your hammer and block plane, and you will not need your block-plane if you have been careful to cut the angles like the pattern, and you have no nails to set to hold your siding while you mark it.

Looking After Little Things

It is the little things that often escape our notice, and yet it is the little things that count, and that cause so many jobs to be a profit or a loss, just in accordance to the way we look after them. The man who looks after the little things in any calling is the successful man, and especially is this true of the carpenter trade. It should be our aim to look closely after all the minor details of a job and learn to do our work in the way that requires the least labor. Who has not been around where carpenters were at work without noticing the amount of work that is being done that does not advance the job at all, but is the result of dragging along in the same old rut and not learning the latest methods of doing things. It is the rule with carpenters in some sections to rabbet frieze lumber to receive the siding, and when asked why they do so frankly confess that they know of no other method. One way of getting around this disagreeable task is to take common lath and cut them in lengths about two inches shorter than the frieze board is wide. Nail these to the sheathing all around the house, placing them directly over each studding, where the frieze is to be nailed and when the frieze is placed over these it will project over the strips and allow the siding to slip up under just the same as if the old method has been followed; besides, you can use seven-eighths inch lumber for the frieze and when the job is done it will have all the appearance of one and one-quarter inch stuff having been used, so it will be seen that this method saves material, as well as a great amount of hard labor.

Scaffold Brackets

Thinking probably some of the craft might be interested in the scaffolding ideas we herewith pub-



lish a sketch of one that has been very successful. The arms are made of 2 by 4 surfaced white pine and the braces of 1 by 4 as above. All parts are made exactly alike so as to be interchangeable in case of accident. The braces are let in with a shoulder to give additional strength. Bore the hole exactly the same distance from the heel and see that the bolt fits tight to prevent turning. Use a large washer under the head of the bolt. These brackets can be bolted to Byrkett sheathing the same as on the common sheathing, or can be stood on the ground with the short arm turned to the wall and make a good scaffold for siding. If they are painted it adds to their durability and appearance.

Finishing Porch Floors

Question:—I have a veranda floor of Southern pine and want to finish it natural. It is on the side most exposed to the sun and rain. Will you please tell me how to finish it?

Answer:—The first essential for finishing a porch or veranda floor so that the finish shall be reasonably permanent is to protect it from dampness that rises from beneath. To do this, it is necessary that the under sides of the floor boards should be thoroughly painted before being laid, with a heavy coat of rough paint. Any odds and ends will answer, or the mineral brown used for painting freight cars, barns and tin roofs makes an excellent paint for this purpose. A second coat of paint, after the floor boards have been laid, should also be given if there is space enough under the floor to permit of doing this. It is also advis-

able to lay the joints in white lead; using the ordinary pure white lead in oil, made enough thinner with pure linseed oil to permit it being pushed into the grooves of the boards with a putty knife before the boards are driven together.

If the floor is to be painted, it should be given three coats of paint, at least. The priming and second coats should be preferably pure white lead, thinned with linseed oil and turpentine, and well brushed into the wood. All cracks must be thoroughly filled with pure whiting and linseed oil putty after the first coat. The floor must be thoroughly cleaned before priming and all mud, plaster, grease or other dirt entirely removed. The surface must be thoroughly dry, and no painting should be done immediately after a frost, heavy dew or rain. The third coat may be more oily than the undercoats. Good work cannot be done with less than three coats; four are better. The last coat of paint must be brushed out smoothly and evenly so as not to leave heavy places which will dry unevenly and soon wear out.

A natural finish for a porch floor is much more difficult to make satisfactory. There is an almost unavoidable tendency to darken, especially on yellow or Southern pine. The same precaution should be taken in regard to protecting the floor from underneath as if it were to be painted. After the boards have been thoroughly cleaned they should be filled with a good paste filler (silex), applied to five or six boards at a time, allowed to set, but not to get hard, and then rubbed well into the grain of the wood, rubbing across the grain, with burlap. Any excess of filler must be wiped off with a soft rag. Many painters regard the use of paste filler on yellow pine as absurd, but it gives a solid foundation for a floor that cannot be obtained in any other way. A porch floor is obliged to stand wear and tear and exposure to the weather and for this reason the ordinary floor varnish is unsatisfactory. Three or four coats of the best exterior varnish or spar coating should be used, allowing not less than four days between the coats, and if possible, at least a week should be allowed after the last coat is applied before the floor is walked upon. When the floor becomes scratched its luster can be restored by rubbing with crude oil or an oil polish.

A Transom Window Frame

Will you please give a description and detail of a transom window frame, allowing for a three-inch bar with hinged transom light?

Answer:—The most satisfactory way we have found is to make the frame as for an ordinary two-sash window and make the meeting rail as shown in section at Fig. 1. This has the appearance of a moulded transom bar. The sash being hung the same as in the ordinary window it allows it to be lowered at will, leaving no open joints for the wind and rain to get in when closed. It is well nigh impossible to construct a transom when hung with butts and have it weather-proof. In such cases the most satisfactory way we have found is to hang the sash at the bottom similar to that

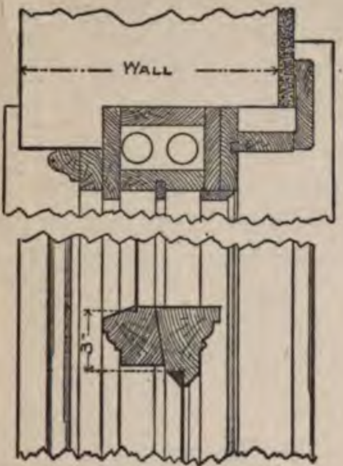


Fig. 1.

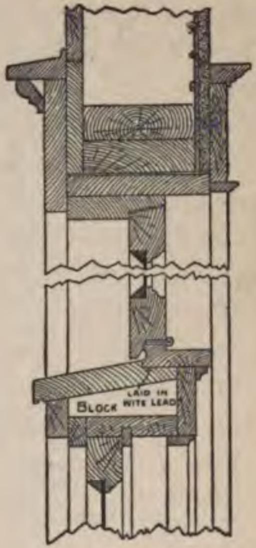


Fig. 2.

shown in Fig. 2. This makes a fairly tight job and is simple in construction.

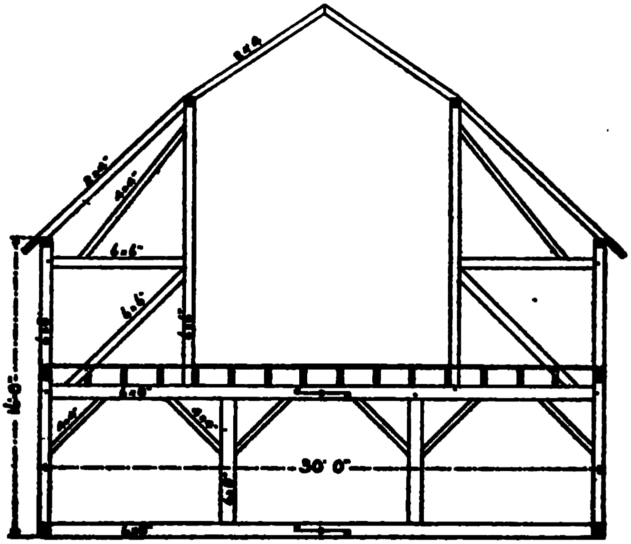
How to Put Ropes in Windows

To put new ropes in windows, take off the strips and hold the lower sash in place. You will find a pocket in the casing about ten inches from the bottom, where the weights are concealed. Take the old ropes from the weights and sash, taking note of the method of fastening. Cut the rope to be put in three-quarters as long as the window. Take a small piece of iron that will slip through the pulleys easily and fasten it to a piece of twine.

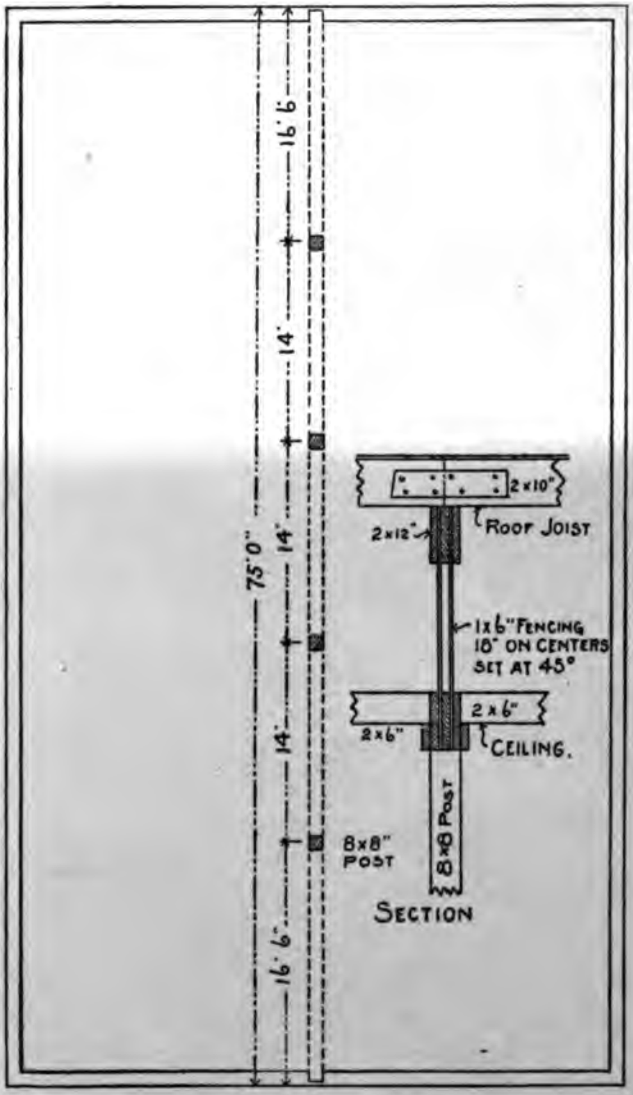
Tie the other end of the twine to the rope. Drop the small weight through the pulley until it comes down to the pocket. Pull the rope through the pulley and fasten it to the window weight and the sash in the same manner as the old one. Replace the sash and the side strips.

Plan of a Barn

A farmer wants a barn with an abundance of hay room. He also wants as little timber in the mow as possible. We find that a good many carpenters are puzzled when it comes to framing a barn so as not to have much timber in the way and make a good substantial job. We print a plan of a country barn that pleases all who see it. It is the center bent to which attention is called.



Cross Section.


16' 6"
14'
14'
75' 0"
14'
16' 6"
8x8" POST
2x10"
ROOF JOIST
2x12"
1x6" FENCING 18" ON CENTERS SET AT 45°
2x6"
2x6"
CEILING.
8x8 POST
SECTION

Supporting a Ceiling

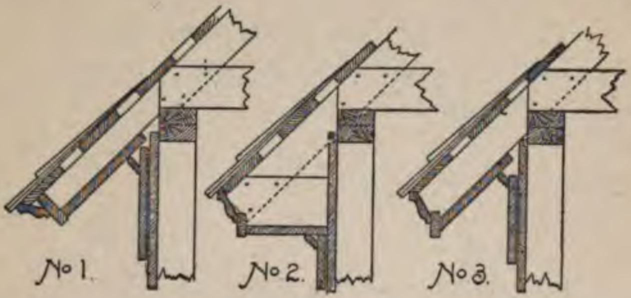
Question:—A patron of mine wishes to build a one-story store building forty-three by seventy-five feet, all in one room. Ceiling joist will be two by twelve, using ten by ten or twelve by twelve pine columns made of two by ten or two by twelve pine. Will they be of sufficient strength, and how far apart should they be to support the ceiling joist and roof through the center? The outer walls will be of brick, roof of iron.

Answer:—We will answer the above by submitting a floor plan showing the arrangement of the posts and girder. For the latter we recommend building a lattice truss girder made of two by twelve-inch joists, as shown in the section. The lattice to be of fencing plank set on eighteen-inch centers and at an angle of forty-five degrees. The upper chord to have a fall or pitch of not less than five-eighths of an inch to the foot. On the sides of the lower chord a two by six is spiked to receive the ends of the ceiling joists. For the roof joists we show two by ten, which set on twenty-four-inch centers will be sufficient for a span of this width. We would recommend using eight by eight dressed yellow pine for the posts.

How to Join the Crown Mould

Question:—Where two roofs come together with a valley, do you cut the ends at the rafters square or plumb with the building?

Answer:—If it is a cornice like No. 1 it is proper to cut the ends at the rafters square, but if it is a box cornice like No. 2, then the crown mould should be set plumb. A cornice like No. 3 will not

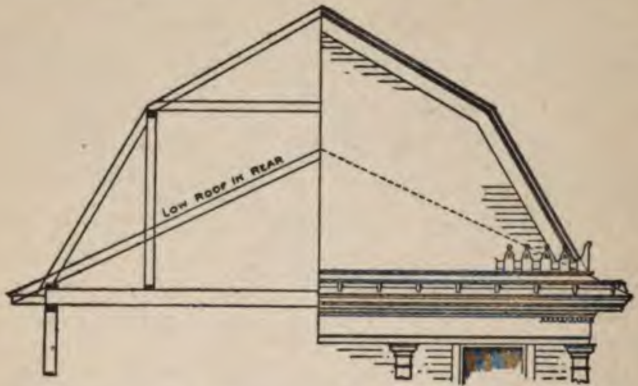


work well where there are gables, because the crown mould will not member with that of the gable.

Gutter for Gambrel Roof

Question:—I am figuring on a small cottage with a gambrel roof and I would like to know the kind of gutter which is best suited to this style of roof. The cornice is to continue all around the house, connecting with a veranda in front and a low hip roof in the rear.

Answer:—The accompanying illustration shows about all there is to be said of a combination roof and gutter for a house of this kind. The gutter is what is generally termed "Yankee gutter," and, as it is to run all around the roof, would suggest that the gutter be set near the eave with no shingles underneath, using instead a seven-eighths inch board to form the eave drip and on which to rest the brackets. Would set the gutter level and grade on the inside with false bottom. Use good quality of tin for the lining and start double course of shingles about level with top of gutter. If the



hip roof in the rear interferes with the window space of the main part it could be changed to a deck roof.

Facts About Doors

Question:—I have several questions I would like to have answered: 1. How should double sliding doors be fastened in center to prevent sliding farther than they should? 2. What kind of stop should be used? 3. Which is the most proper way to put on corner block, with grain running vertical or horizontal?

Answer:—1. The sliding is prevented by overhead track that door slides on, and also by rollers. If it is a pair of sliding doors, it should have a knuckle joint or astragal, although some sliding doors are banded, making it unnecessary to use either knuckle or astragal. 2. It is customary to use ⅜ or ½ inch stop, depending on the width.

3. Corner blocks should have the grain running horizontal, so it will match with the casing.

Constructing "Saw Horses"

In making heavy saw horses use 4 by 4, 4½ feet long, and gain in on each side 1 inch on top to nothing at the bottom. This gives about the right slope to the legs at the bottom. Use 2 by 4 for legs and a brace of 2 by 6 cut between them just underneath the top; then cut a wedge 2 by 6 and 1 foot long and nail fast against the cross piece and on under side of the top. All the rest is pinned with hardwood pins to prevent dulling of saws when you happen to cut into the horse. We find for heavy work the above will stand almost any amount of strain.

Constructing a Circular Porch

Question:—Kindly tell me how to construct a circular porch. Illustrate if possible.

Answer:—The accompanying illustration at Fig. 1 shows the method that we have used in our own work for a number of years and is probably as good as any other. The central part of the illustration shows the frame work of the floor joists with a portion of the flooring in position.

There should be supports at C, B and D. From C to D is one-quarter of a circle, and this is divided in the center, as at B, then the straight lines C–B and B–D are equal to the sides of an octagon with a circumscribed radius of seven feet and eight inches, which is the width of the frame-

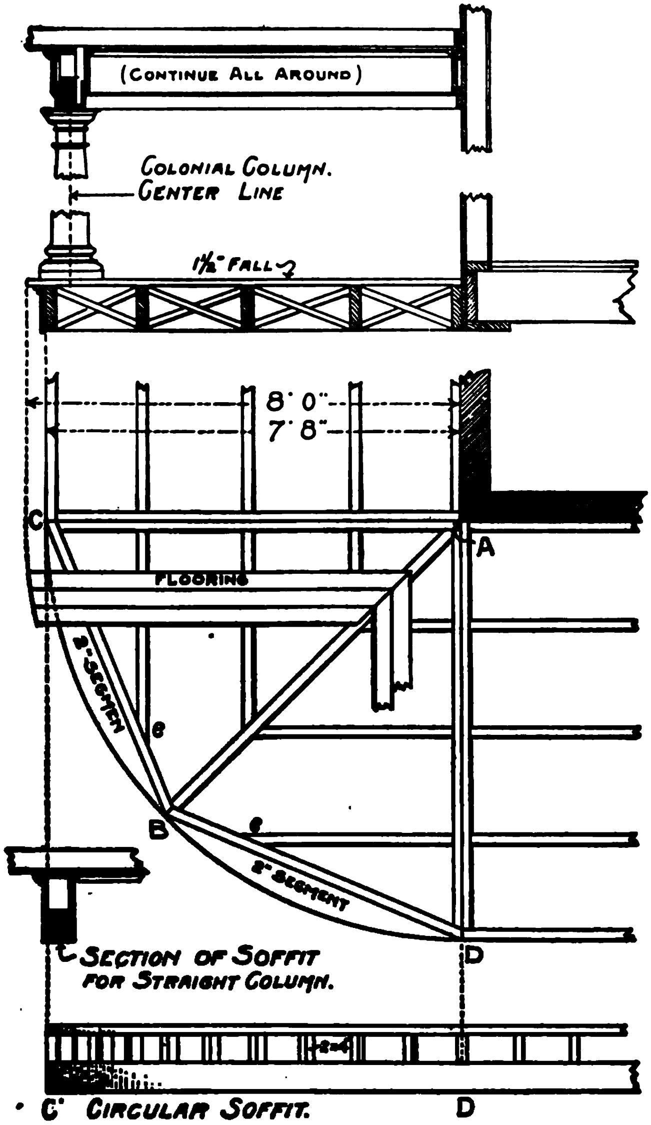

(CONTINUE ALL AROUND)
COLONIAL COLUMN.
CENTER LINE
1½" FALL
8' 0"
7' 8"
C
A
FLOORING
2" SEGMENT
e
B
e
2" SEGMENT
D
SECTION OF SOFFIT FOR STRAIGHT COLUMN.
2×4
C' CIRCULAR SOFFIT.
D

FIG. 1.

work of the porch, and the length of the sides may be found by multiplying the radius by the decimal 9.18, which equals five feet ten and three-eighths inches, and is the length to cut the side pieces and is also the length of the chord of the segment to form the circle to receive the base.

In the absence of the above decimal or in case a person is not apt in figures, these parts may be found as shown in Fig. 2. By placing the square on a board, from which the segment is to be cut, with the figures that give the octagon cuts and lay off the raidius in line with the blade, as shown, describe the arc, and it is ready to cut. The figures shown on the square will give all of the cuts required in the frame work about the octagon, as the blade will give all of the cuts at B, also at the other end of the side pieces at C and D. The tongue will give the cut at e and e. The other cuts are the square or on the 45 degree angle. Thus, from this it will be seen that all of the pieces can be successfully framed without first building a part of the framework and scribing the other pieces to it as is the general custom.

There should be four of the segment pieces gotten out, setting one flush with the top edge and one at the lower edge of the joists. The upper ones should be of one and three-fourth inch stuff, same as the joists, while seven-eighths will be sufficient for the lower member. Set blocks between these segments, nailing them well to the joists, also set a few blocks flush with the face of the segments which makes an excellent form to secure the base.

The ceiling joists are usually put on the narrow way of the porch with an angle piece same as at A–B, on which to form the miter joint of the ceiling.

To form the soffit we use seven-eighths by six or eight-inch sized boards and spring them to their proper place just the same as building a circular girder. The first board should be sprung to a form and the next board well nailed to this one, and so on till the soffit is to the required thickness or

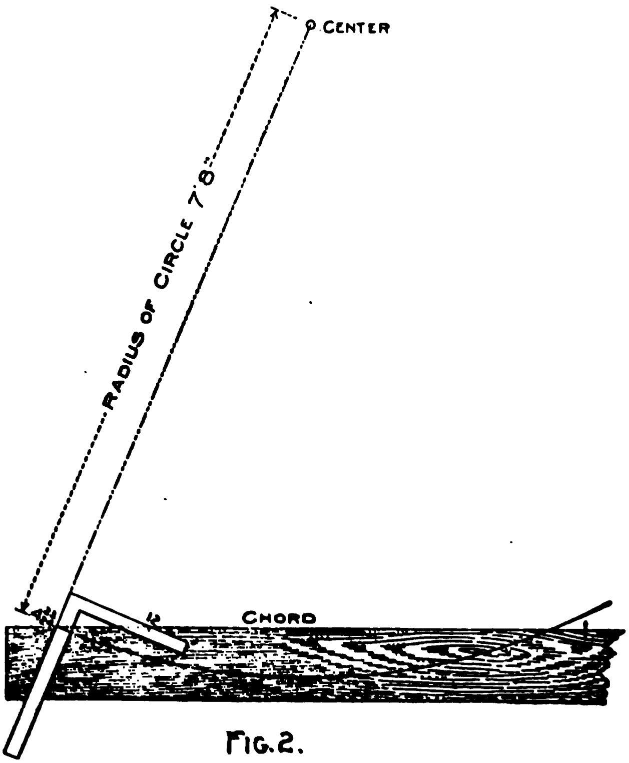


FIG. 2.

strength, and as it is not always necessary to build to the full width desired as it can easily be furred out to the required width. The soffit should be continuous; that is, for the straight part as well as for the circle. Long boards should be used so as to lap well around the circular part, being careful not to break joints on the circular part or at C or D.

A soffit if properly built in this way will not necessarily need a column set at B, as it will be self-supporting. If straight columns are used the outer face of the framework should be flush with the framework below, but if tapered or colonial columns are to be used, then the center of the soffit should rest over the center of the column, as shown in the upper part of the illustration of Fig. 1.

In case a deep frieze is wanted, it may be had by building on top of the soffit girder with blocks, and putting a formed plate on these. For all circular mouldings, it is better to have them solid and they will then always stay in place, as there will be no kerf joints to open up after the work is completed.

Strength of Beams

Question:—Will a beam, made by spiking seven 2 by 8's together equal 14 inches by 8 inches, 50 feet long, supported in the center by post, sustain a tar and gravel roof with joists 2 feet on center and hay loft of 10 feet high with hay? Two loft posts in sum of 50 feet, the two loft posts stand out from center post 8 feet on each side.

Answer:—The width of the building is not stated, but presume the joists are not over 24 feet. The construction indicated would be rather weak in case of a full mow of hay and the possible chance of a heavy snow on the roof. Would suggest that five 2 by 14's be used, well spiked together; this will give a girder of about 9 by 14 and not much more lumber.

Building Construction

Question:—Here is a business house 33 feet by 135 feet, five stories high. The first, second and third stories will be used for a furniture store, fourth story for a ball room, fifth story for a lodge room. Now will 3 inch by 14 inch pine placed 12 inches on center, which will be nine inches between, with four rows of bridging, carry the weight, bridging to be 2 inches by 4 inches, nailed with two 12 penny nails in each end of the bridge?

Answer:—The size 3 by 14 placed on 12 inch centers will be sufficient to carry the loads the floors will be subject to, but would recommend that the timbers be cut full size, and as these timbers will probably have to be sawed to order it would be well to have them gotten out several months in advance of using, so they will be seasoned so as to avoid shrinkage after being placed in the building. The joists should be sized to even depths with a camber of at least 1 inch. Four rows of 2 by 4 bridging is all right. Would also recommend laying a rough floor diagonally with the finished floor, the latter to be laid after all the plastering and rough work is done. Do not let the plumbers notch into the joists further out than three feet from the ends of the joists.

Cutting Rafters

We wish to make a small note right here which may set right some of the younger members of the craft and a few of the older heads who never paid any attention to it; in fact, we saw a contractor cut the rafters on a three thousand dollar house in the same faulty way. It is in the manner of adding the projection for cornice. Fig. 1 is the wrong way and makes the rafters too short, causing the ridge joint to open as shown in Fig. 2. The right way is shown in Fig. 3.

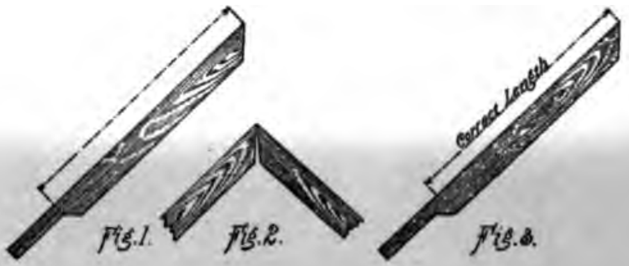
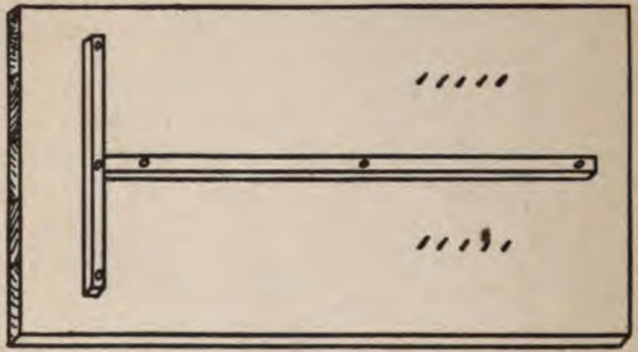


Fig. 1. Fig. 2. Fig. 3.

Sash Pulley Gauge and Marker

We show herewith a drawing of a sash-pulley gauge and marker, such as is used. Take a piece seven-eighths by six inches wide and eight inches long. Then take a piece of parting stop one-fourth by one-half inches, nail on as shown in drawing the piece running lengthwise drops in groove in jamb which is plowed for parting stop. The piece running crosswise rests in the gain which is made for the header. The dots represent brads which come up about one-eighth of an inch and are filed sharp. When you drop it in place give it a tap with the hammer and the brads do the rest.

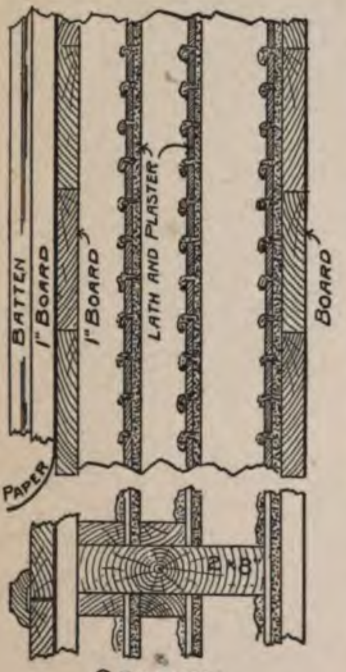


MARKER FOR SASH PULLEYS

Both pulleys are marked at once. Set the point of the bit where the brads marked and your pulleys will fit as if they had grown there. Of course different makes of pulleys need different kind of markers.

A Non-Freezing Potato House

Question:—I am called upon to make a plan of a potato warehouse in which lumber will be the main material, and, of course, it must be frost proof as much as possible. I have thought of making walls like accompanying sketch. The studs will be 2 by 8 set on 16-inch centers. On the outside are first placed one-inch boards horizontally with the studs, and over this are one-inch boards placed perpendicularly, with building paper between them, and the cracks are covered with buttons. There will be two courses of black plaster as shown, making three dead air spaces in the width of the wall. The inside of the wall is lathed and plastered, and over this boards are placed for the protection of the plastered walls. The main object is to keep the frost out.

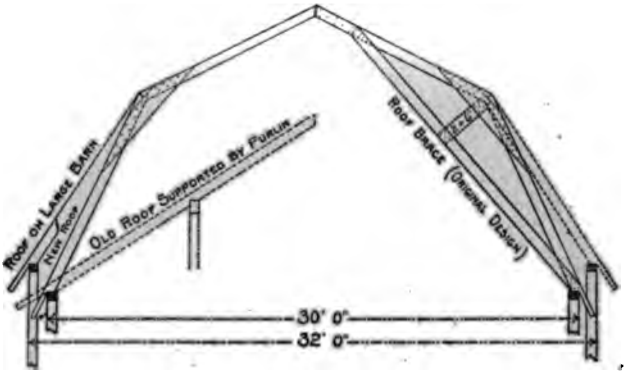


SECTION.

Answer:—We herewith produce the sketch. The plan is all right, provided all parts of the building are constructed accordingly tight. The three dead air spaces will act as a non-conductor of frost sufficiently to protect the interior from freezing in most sections of the country where potatoes are raised. However, we would suggest putting two or three thicknesses of paper between the outer boards. Would use tarred felt for the last layer.

Brace for Gambrel Roof

The accompanying sketch illustrates a brace for gambrel roof to be used instead of the purlin support. There are two barns of different widths and heights joined end to end. The larger barn is thirty-two by fifty feet, with regular gambrel roof. The horse-barn, which is joined on, had an old-fashioned one-third pitch roof supported by purlin plate and posts, as indicated. This ancient arrangement necessitated the use of two separate tracks, compelling the owner when wishing to put hay into the horse-barn to shift the car from the upper to the lower track. In order to get rid of this great inconvenience it was decided to raise the roof on the horse-barn so as to have one straight ridge the entire length of the two barns, and thus secure the one track desired. It was found after the old roof had been raised to the gambrel form that its strength was not sufficient to load and carry a hay fork. The owner desired if possible to

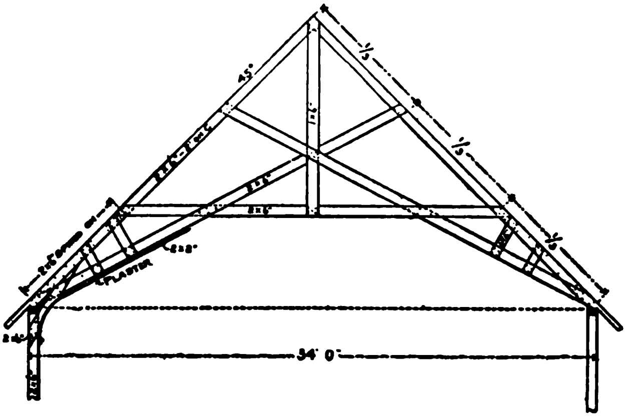


avoid the use of the purlin support, and the result was the brace shown in the illustration, which is constructed as follows: Take a two by six inches by twenty feet, cut it to fit on plate at bottom and strike rafter about two feet from ridge. Spike it thoroughly at top and bottom with number twenty nails. Cut a piece of two by six inches to fit snugly between ridge and top of long brace well spiked to rafter. Repeat this operation on the opposite side of the same rafter. Introduce a tie brace of two by six inches at the buckle, which is thoroughly spiked in as shown. Repeat this operation on the opposite side of the roof and you have in effect a pair of trusses where before you had only a pair of rafters. This brace would ordinarily suffice with one, two by six inches by twenty feet, instead of two placed six or eight feet apart. This plan makes a stronger roof than the purlin, and its construction requires less of both material and labor.

Trussing a Roof

Question:—What would be the proper way to truss a roof on a span of thirty-four feet, using two by six for the rafters, with roof to have a pitch of forty-five degrees, the ceiling to raise six feet above the plate? This is for a church, and would like very much to have a diagram of the trussing of the roof. Want it sufficiently strong to keep the plaster from cracking. Also what is your opinion about using two by four for the studding, which are to be fourteen feet high?

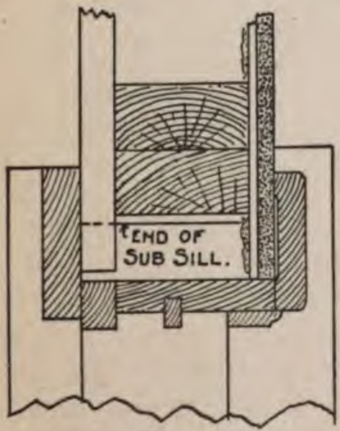
Answer:—In answer to the above we herewith print a diagram of the truss as per the dimensions given, which we presume is for a common shingle roof. The timbers required will be twenty-six feet in length for the common and tie rafters and twenty-four feet for the collar beam. At the seat of the rafters we use a two by six piece circled out to form a cove as shown. This piece should be

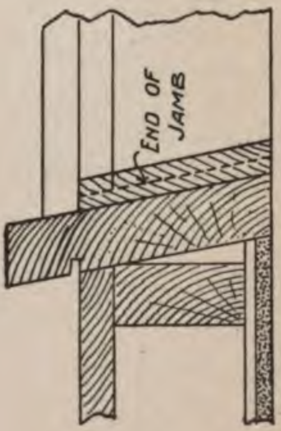


thoroughly spiked to the studding and to the side of the tie rafter and to the under edge of the common rafter. However, only one-third of these pieces will catch the rafters, owing to their being spaced on twenty-four inch centers, thus requiring the other pieces to be framed in between the rafters. Other timbers in the truss are of one by six fencing plank. All parts should be thoroughly spiked together. Cross pieces of two by two stuff are used to receive the lath, for which we would recommend using expanded metal lath. The level ceiling will lack a few inches of being six feet above the plate, but the timbers will work to a better advantage and will make a stronger job. As to the last question, we would by all means recommend using two by six studding for a building of this kind. What is called two by four is really only three and five-eighths in width, which is too narrow even if stout enough to give the proper width at the window jambs to receive the sash and other trim. -

Preventing Leaky Window Frame

Question: I wish you would explain with an illustrated sketch the proper way to make a window frame, for an ordinary frame building, to gain into the sill or into the jamb so as to prevent leak.





Answer: The most satisfactory way we have found is to gain the jamb into the subsill, leaving the end of this sill project same as for window sill, and only notch out enough of the back corners to fit nicely in opening for the window as shown by the sectional drawing. The joints should be set in white lead. and well painted on the outside.

Quarter Sawing Oak

Question: Would you please inform me as to what system is used in quarter sawing oak? I have never seen this done and hear of several ways. What I want to know is in what shape they cut the log.

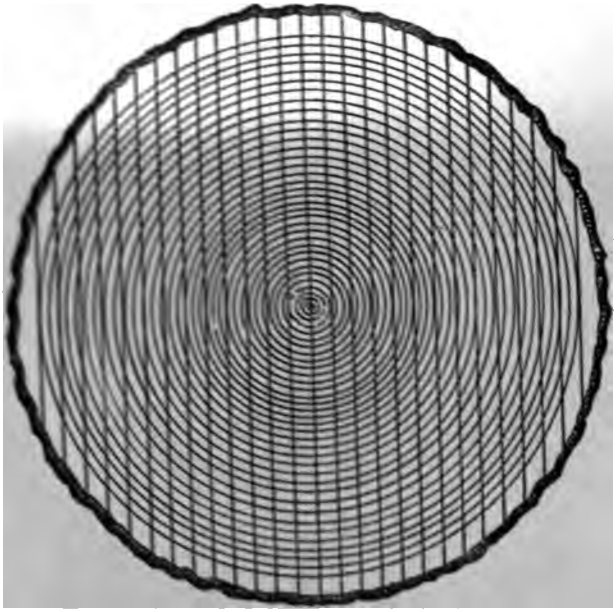


Fig. 1.

Answer: Quarter sawing is simply the manipulation of the log on the carriage to the saw, cutting the same into boards so that the grain of the wood runs from perpendicular to obliquely with the face of the board, showing the edge instead of the flat grain. If the log is worked into boards parallel with one another, as shown in Fig. 1, only a portion of the log will be cut into what is called quarter sawed boards, but if the log is first quartered as shown in Fig. 2 (hence the name), and these pieces again sawed into boards as shown,

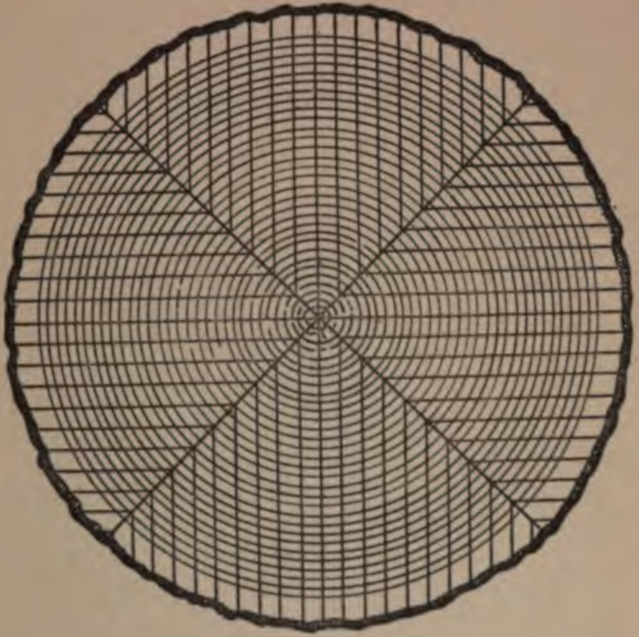
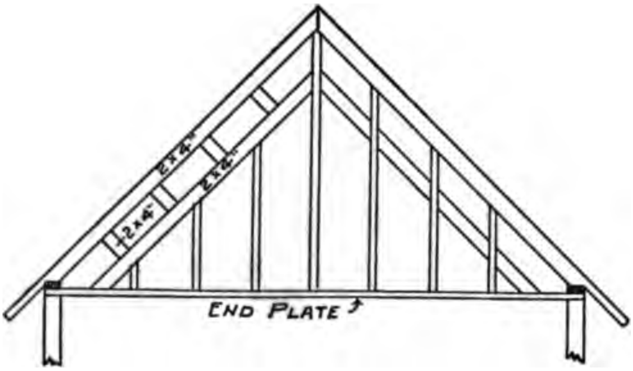


FIG. 2.

then most all of the log will have been quarter sawed. The same result may be accomplished by first sawing the log into halves, then turn one of these pieces on the carriage so that the sawed side will rest at an angle of 45 degrees with the saw, then saw the same into boards up to the original center of the log. Then turn the piece until the last cut again stands at an angle of 45 degrees and proceed as before and continue until the whole piece is worked up into boards.

Putting in Snow Blocks

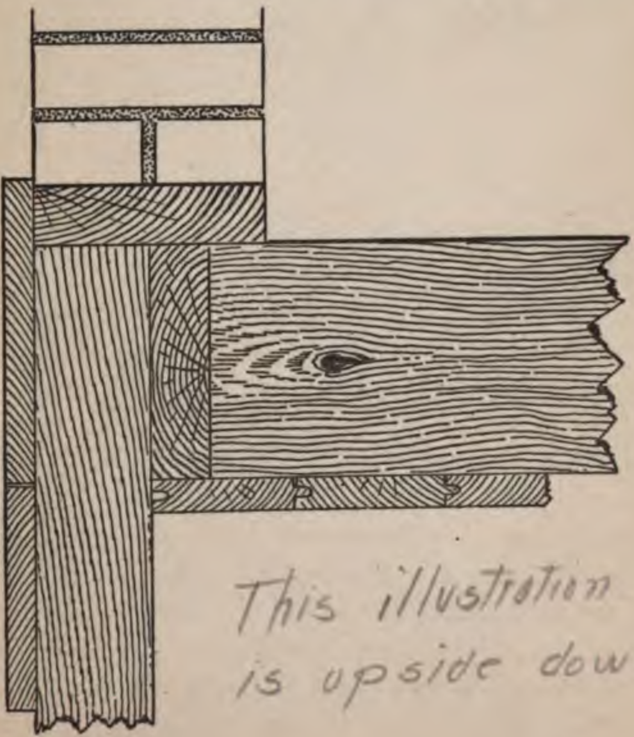
We herewith submit a sketch of a way of putting in snow blocks, which in the way they are commonly put in are always more or less of annoyance. In the sketch, both the common and our way are shown. In the common way the blocks are pieces of 2 by 4, cut in between the gable studs, which if not extremely well nailed will become loosened in nailing on the siding. In this way the blocks are in one continual piece, fastened



n center to the gable stud just low enough to receive the siding and cornice. While this plan may be old to some, it may be new to many. It is often some of the simple things that are of much importance.

Box Sill for Frame Buildings

As we have never seen any cuts of a box sill for frame buildings given, we print the following plan. The advantages of a sill made this way are, first, you get the full strength of the studding;



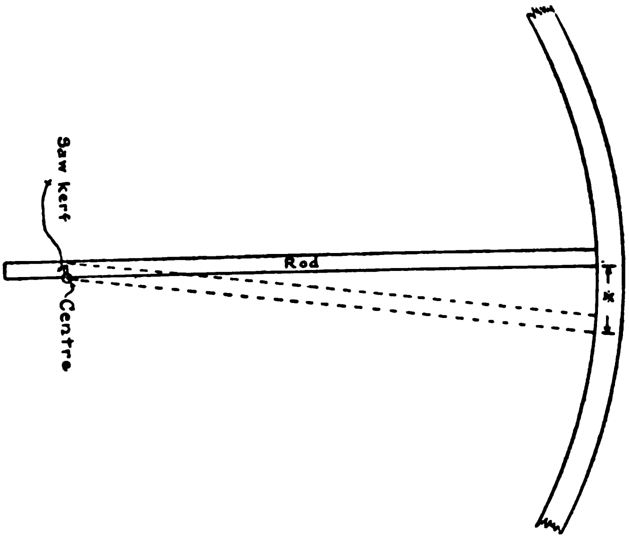
This illustration
is upside down

second, less work cutting same; third, it makes a tight job all around, so wind, mice or rats cannot get into the house or between the partitions; fourth, it is easier to lay floor, as you have no studding to cut around.

Sawing Kerfs

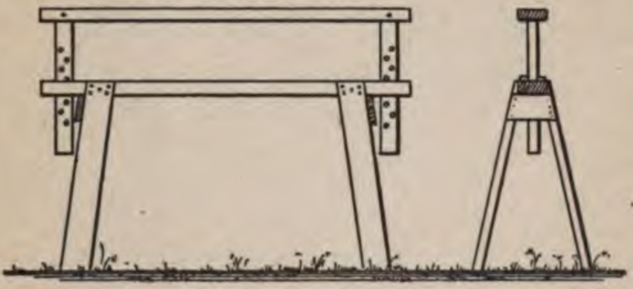
Herewith is a simple sketch of a method of finding the distance between saw kerfs for bending a board around a curve.

Take a rod and saw a kerf in it at the center, from which the curve was struck. Hold the short end beyond the center quite still, then move the end of the rod round the curve until the saw kerf closes, and the distance traversed by the rod along the curve gives the distance apart of kerfs.



Adjustable Trestles

We print a sketch of a pair of trestles which we think are pretty handy and save the carpenter lots of stooping. There are times when it is not necessary to have the trestles so low as we commonly use them; for instance, when working with screens, blinds and sashes. Cut a mortise about one by two and three-quarter inches in each end, say about three inches from each end of the trestle. Take a two by four the same length as the trestles and cut a mortise same as in trestles, only not so long. Take two pieces one by two and one-half inches and two feet long. Hardwood is the best. Fit these pieces tightly into mortise in two by four and pin. Now bore holes in the one by two and one-half inch pieces in a zigzag manner and about two inches apart, and you have it complete. The holes should be a little larger than a large spike nail. You can see by having one of these for each trestle that you can raise and lower your work as it suits you best. Raise to the height wanted and slip a spike in the hole above the trestle and it will stay there until you change it.



Remedy fer Sweating Wall

Please give me some formula for dressing a basement to keep it from sweating. I have built two basements, and in damp weather the walls sweat and drip so that it becomes wet and everything kept inside inclines to mold. Is there anything that I could apply to prevent it? Will another coat of plaster stop it?

Answer: The following will greatly relieve the sweating of any basement whose wall admits water during rainy seasons. The first step is to select a dry period and clean the wall thoroughly. Then apply with a brush a composition previously prepared of one pound liquid shellac, twelve parts coal tar and twenty parts Portland cement, add sufficient turpentine to bring same to the consistency of paint and apply on dry wall. Before it has hardened, cover same with lime whitewash, and when dry apply a second coat of whitewash.

Flues in Chimneys

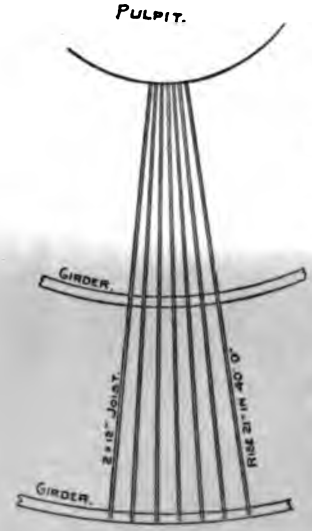
Question: I am going to build a chimney about twenty-four feet high. It will start on a center wall below the floor? Can I put in it a flue so as to take the cold air off in the winter?

Answer: Yes, but it should be an independent flue. In other words, it can be built alongside of the smoke flue and would, in fact, be a benefit because the warm air thrown off from same would help to create a draft in the ventilating flue. We would recommend putting in two ventilating registers. One at the floor and one at the ceiling.

The upper one to be closed in cold weather and the lower one in warm weather.

Laying a Church Floor

Question: Here is a sketch of a bowl-shaped church floor. What is the proper way of laying the flooring? We will use two floors, a rough floor and a top floor.



Answer: We herewith reproduce the sketch mentioned above. As the incline in this floor is only slightly over one-half inch to the foot, it will be a very easy matter to spring the boards to the required shape. The finished floor should all run one way, but the under floor should run diagonal to the upper one to prevent the shrinkage from showing up in the finished floor. The joists being laid fan shape will require the under floor to be laid at different angles. For this floor would recommend using surfaced one by six boards laid close and well nailed.

Estimated Cost of Labor in Building

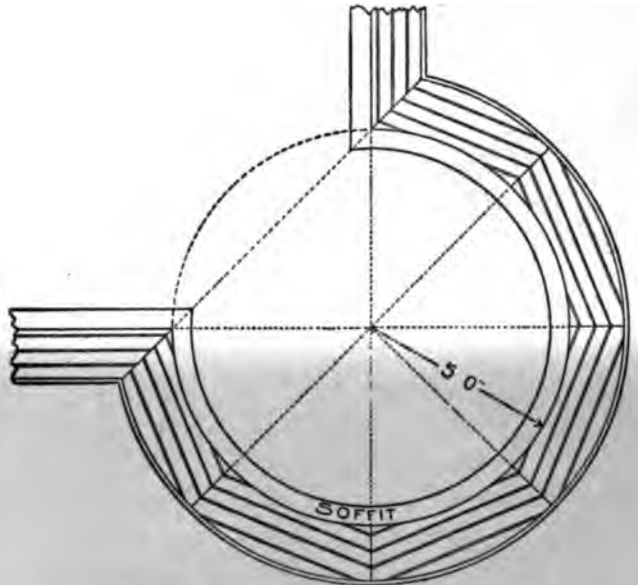
Question: I would like to know how you estimate the price of labor of a house or barn and the amount of nails needed for a building.

Answer: The easiest way to estimate the labor, and one that is practical, is to estimate rough work by the thousand feet of lumber, and the finishing a per cent of the cost of the mill work, thus: Estimate the labor of framing dimension lumber at eight to ten dollars per thousand feet, board measure; sheathing, eight dollars per thousand; flooring, twelve to twenty dollars, according to kind; siding, twelve to twenty dollars, according to kind, whether narrow or wide, or mitered corners or not; shingling, one dollar and one-half per thousand; cornice and belt courses, two to four cents per member per lineal foot; porches, one to one and one-half dollar per lineal foot for labor; finishing, thirty to thirty-five per cent of the cost of the mill work. Mill work includes the sash, doors, blinds, casing and base and all moldings. Nails, per thousand feet required are about as follows: Framing, twenty to twenty-five pounds twelve to sixteen penny; sheathing, eighteen to twenty pounds eight penny; siding, fifteen to eighteen pounds six penny; flooring, twenty to twenty-five pounds eight penny nails; shingling, four pounds per thousand shingles.

How to Ceil a Circular Plancier

Question: Enclosed find a sketch of a porch that I intend running a plancier of ⅝ by 4-inch ceiling. I have a ¾ circle on one corner and want to carry the ceiling around the circle. Could I divide it into an octagon or would the pieces be too long?

Answer: We herewith reproduce the sketch showing the ¾ part of the circle divided up into octagonal parts, which is all right, but would look



better if divided into twelve parts. This would show nine parts instead of six in the ¾ circle.

Constructing a Cess-pool

Question: Will you kindly advise me as to the best method of constructing a cess-pool; also for connecting same with bath room?

Answer: The building of cess-pools should be avoided whenever possible, but in many villages and country homes the proper drainage or sewer connections are not always to be had, and in that case the cess-pool is the last resort.

It should be built with as much care as constructing a cistern with walls of brick laid in mortar and well plastered with best quality of cement and provided with cast-iron man-hole and cover.

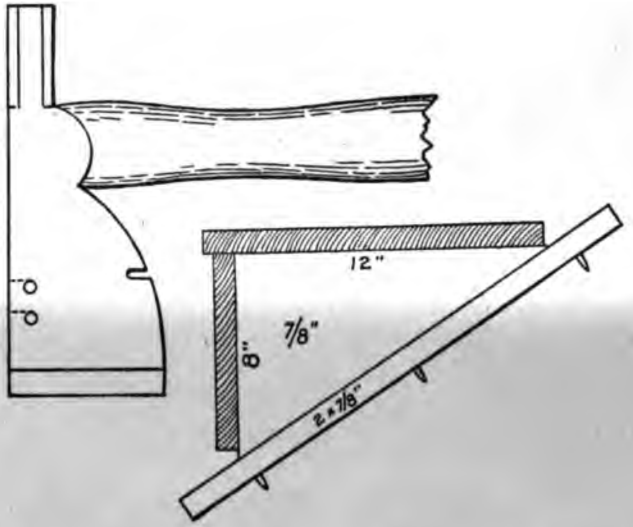
The sewer connection should be thoroughly back trapped. Once or twice a year the contents should be dipped out and carted away. We have known cess-pools constructed without cementing the walls for the purpose of allowing the liquid matter to seep away in the gravel or loose formation of the soil. thus contaminating the drinking water in nearby wells and possibly in some cases hundreds of feet away.

Modern convenience is a thing to be cherished in every home, but is it not better to first look well to the possible effect it is going to have on the health of the family and neighbors?

Hatchet for Shingling.

I noticed a plan recently of filing notches on the hatchet at the regular distance for courses. We use somewhat the same method here, but in place of the notches at four and one-half and five inches we drill small holes and thread them for short bolts which screw in. This leaves the end out, and in using no line is needed, as the bolt is drawn up against the course below, when the face of the hatchet gives the next course When used in this way in conjunction with the bracket shown, no chalk line or foot rest is needed. The bracket is very simple. Saw two pieces of seven-eighths stuff eight by twelve inches, and on the sloping

edge nail a strip about two inches wide; drive three or four large nails in this strip and file to a point, leaving them projecting about half an inch; nail a board on top and one on front and your bracket is ready for use. In drilling the holes in the hatchet be sure to measure to the upper edge of hole and not to center.



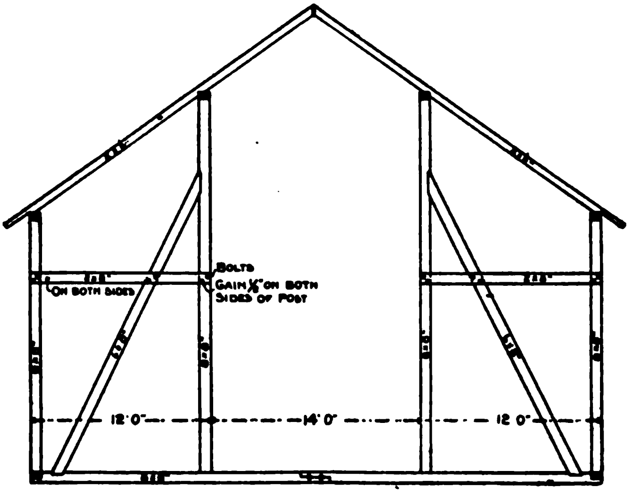
Repainting an Old House.

Question: What is the best way to paint an old house from which most of the paint has gone?

Answer: If the old paint is peeling and scaling, remove as much as possible by scraping or with wire brushes. If powdered, brush well with "duster." Give a coat of oil, mixed in the proportion of four gallons raw linseed oil, one gallon turpentine, about one pint good turpentine driers. If there is still any scaling paint, scrape it off after oiling. When surface is dry, give one coat pure white lead and raw linseed oil, with necessary turpentine and driers, tinted as desired. Final coat of lead and oil or mixed paint of approved quality. This would result in a fairly good job, although three coats over oil coat would be even better.

Bents for a Bank Barn.

Having seen a number of ways for building barn bents, I thought I would send in a sketch of my way, which is very convenient for the use of slings or hay forks. This makes a very simple, yet strong construction. A good way to build large sliding doors for barns to keep them from springing, is to cut the boards to the proper length

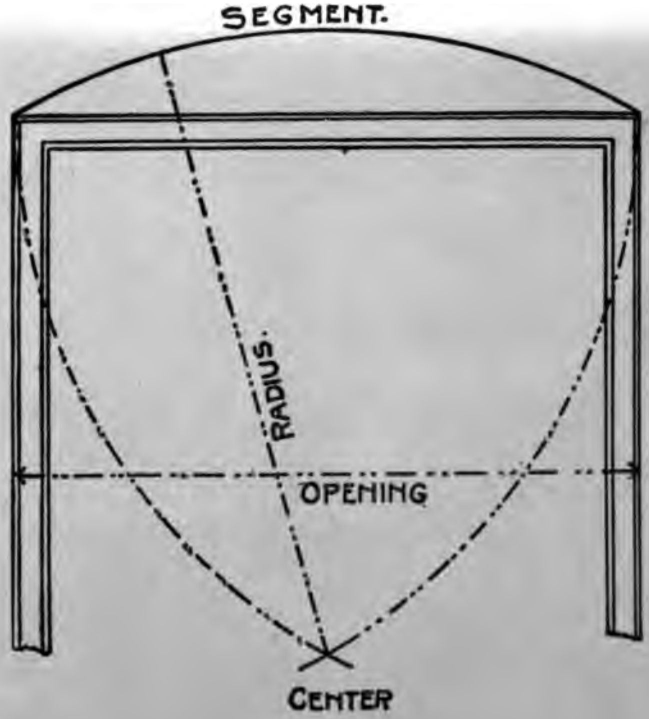


and then stand them edgewise on the trestle and give the grooves a good coat of paint before nailing. This will prevent the siding from swelling. I have followed this way of putting doors together for several years and it has given good satisfaction.

How to Lay Out a Segment Arch

Question: Will you please publish a rule for laying out segments.

Answer: The segment is a sixth part of a circle. The radius being equal the chord, its true shape

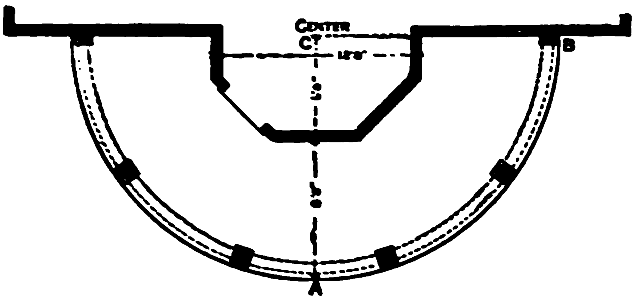


may very easily be found by letting the desired opening represent the chord. The intersection of the arcs locates the center, as shown in the illustration.

How to Build a Circular Porch

Question: Enclosed find a rough sketch of a circular porch to be built around a bay window or tower. Please give me the best method for constructing this porch. How to get the circle true and how to make the plate economical?

Answer: The center being at a point inside the building, prevents striking a circle from same.



It is therefore necessary to make a template of one-half of the semi-circle, as from A to B, and by measuring out 14 feet from C to these points, will locate the placing of the template from which to work out the proper curve in the frame work. The best way to form the sill and plate of this kind is to spring ⅞-inch plank to the proper curve. Five plank will be sufficient for the body of the plate, and from this fur out for the required thickness of the soffit. It is not mentioned what kind of a roof is wanted on the porch. If it is to be a pitched roof with rafters radiating to the center, he will find that they will not strike the octagon on a level line, but will rise higher at the center of the sides and will have to be framed accordingly.

Best Method of Mixing Paint

Question: Please advise me as to the best method of mixing paints and its cost per square foot, including putting on.

Answer: Pure white lead and oil paint exclusive of labor of mixing will cost, say from one dollar and ten cents to one dollar and twenty-five cents per gallon, depending on price of oil and turpentine. Mixed paints of any good quality will range from one dollar and fifty cents to one dollar and seventy-five cents per gallon net. A gallon of paint will cover from four to seven hundred square feet of surface (perhaps even more), one coat, depending on the condition of the surface. Or it will cover from three to five hundred square feet, two coats. On an old painted surface in good condition the covering power is much greater.

Practical Method of Filing Saws

As there have been several questions asked in regard to saws, and as they have been of such a general nature, I have decided that the best way to answer them is to write a brief article covering the entire subject. I will try to be as brief as possible and cover the subject, although I fully realize it is a large one and a great deal should be written to fully give it justice.

As the saw is by far the most important of any of the carpenter's tools, yet how often we see a carpenter almost work his very life out of himself with a saw in bad shape, and yet not do even a fair day's work; again, how often we see mechanics leave an inside job (where the lumber was dry) with their tools in good order and go to framing coarse, wet, cross-grained lumber. Their saws would cut fine until they got in a little ways, and then, as they would not be set enough for that kind of lumber, the saw would bind and it would be almost impossible to continue to push it until the piece was cut, simply because there did not happen to be a set on the job.

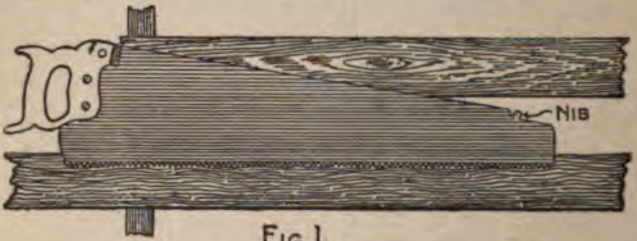


FIG. 1.

How easy these hard, unsatisfactory days could have been made by simply laying the saw down on some studding or joist on the trestles as shown in Fig. 1, and set with a common nail set, which would practically not dull it at all.

A common nail set makes the best saw set I know of to meet the emergency just mentioned. Many claim a hammer set is the only perfect set, while I find for general use the latest hand sets much more convenient. The ornamental nib on point of saw I am glad to say is not put on many of the best saws of to-day.

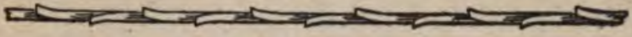


FIG. 2.

Fig. 2 shows the set in a saw which should always be just as little as possible and have the saw run free.

Fig. 3 is a rip saw, which should be filed square across for all ordinary work. The set gives all the bevel the teeth need, as rip saw teeth should march one after the other just like little chisels and cut clear across the tooth and not simply cut on the outside edge as a cross-cut saw, which acts more like jackknife blades on each side of the saw.

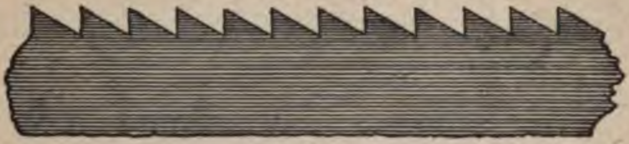


FIG. 3.

Fig. 4 shows the jointing of a saw which is generally done with a flat file. A cut-off saw

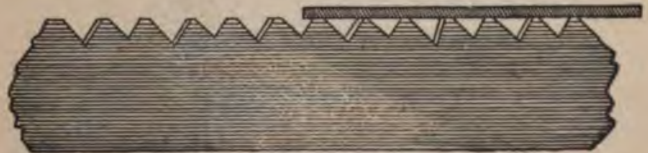


FIG. 4.

should be jointed running while a rip saw should be jointed perfectly straight, although many of them are jointed running and some joint them hollowing.

Fig. 5 illustrates a good way to file a crosscut saw that has [illegible] shape. After

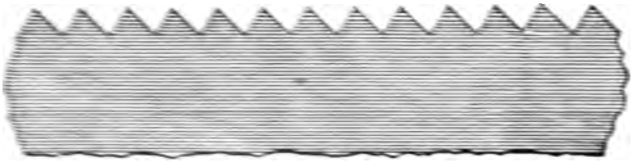


Fig. 5.

the teeth are all made even and the same pitch or rake, then give it proper bevel.

Fig. 6 shows a saw filed with about the right pitch and bevel for ordinary hardwood.

Fig. 7 shows the proper pitch, bevel and fleam, which is the bevel on the back of the tooth, for ordinary soft wood. It also shows the file, which as you will note should point towards the point of

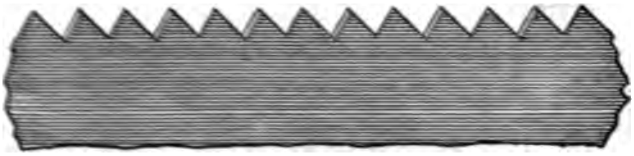


Fig. 6.

the saw. Not only is that my opinion, but all the best authorities I have ever read on the subject give it the same way; still I am free to admit many good mechanics file just the other way.

Fig. 8 shows the groove in a cut-off saw. A needle should run down this groove the full length of the saw if it is well filed. To prove this statement, I just tried my father's old course saw which is not very sharp and has had many kinks in its day. The needle went to full length. If an old saw about 40 years old, filed by a man nearly twice that proves the statement, new saws by young mechanics surely ought to.

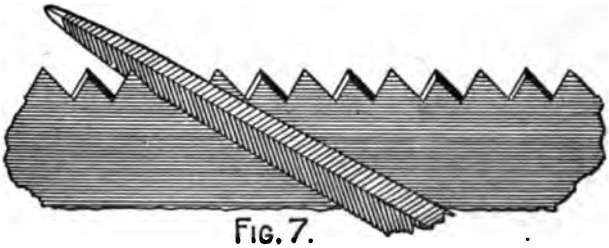


FIG. 7.

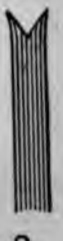


FIG. 8.

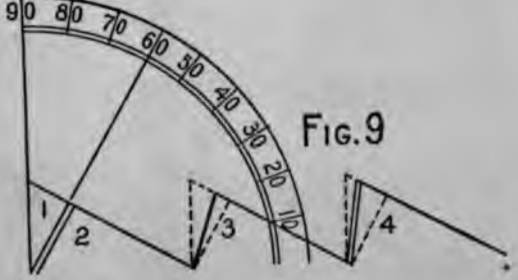


FIG. 9

Fig. 9 gives the degree of pitch. Tooth and the dotted lines show that the rip saw tooth should be on the square or at an angle of 90 degrees. I used to file even just a little sharper than that. Tooth 2, which is 60 degrees, is right for a general cut-off saw. If you wish the saw to cut fast, though possibly not quite as smooth, file it 70 degrees, or more like Tooth 3, while 4 shows a tooth 80 degrees or over, which is about right for a compass saw that rips as much as it cuts off or any similar saw, such as a rip-saw for cross-grained hardwood where it has to do some cutting

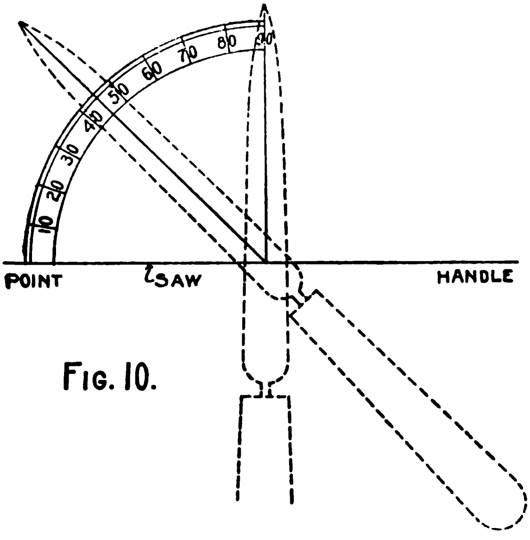


Fig. 10.

across the grain, or a cut-off for sawing diagonal sheathing, or rather cutting, which is as much ripping as cutting off.

Fig. 10 is looking right down onto the edges of the saw and shows that the rip saw should be filed square across or at an angle of 90 degrees with the saw, while a strictly cut-off saw at an angle of 45 degrees, and for the different classes of work the file should swing at different points between 90 degrees and 45 degrees.

Fig. 11 shows how the file should be held level for rip saws, and some even hold it level for all saws, and others drop the handle so the point is raised to about 30 degrees. I seldom raise the point of my file more than 10 degrees.

Anyone who is willing to give the time required to keep a saw in good order (and that time is time well spent) ought to be interested enough in his saw to secure a good one, even if it does cost a little more. A cheap saw is a poor investment at any price, for the files and time it takes to keep it in order would soon pay for the very best.

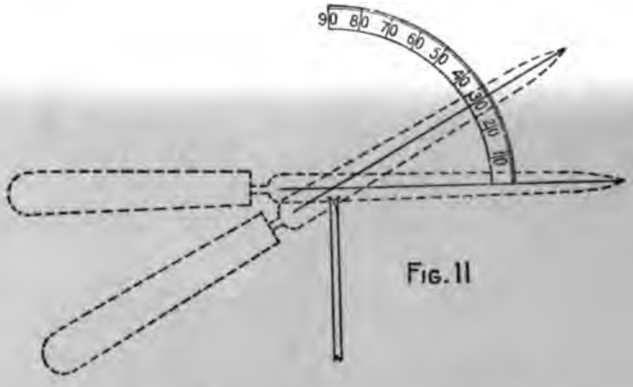


FIG. 11

While there have been no radical changes in saws in my time, yet there have been some improvements, the main improvement being in the perfecting of the steel, until to-day we have silver steel, which stands at the head. The perfection handle which is shown in Fig. 12 by the main lines is also an improvement, while the dotted lines show the old style. The perfection handle is hung as you will notice, more onto the saw and places

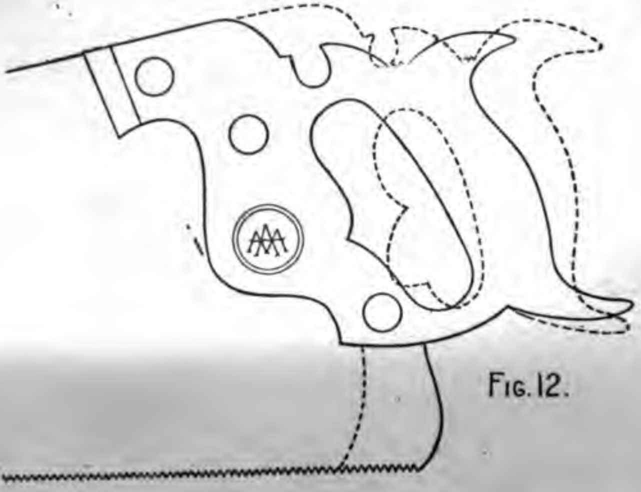


FIG. 12.

your hand nearer your work; this makes the saw hang better and makes your day's work easier.

Constructing Ordinary Stairs

Our object will be to consider carefully the various details of construction, but in order not to be too general in the discussion we must limit ourselves somewhat. A very satisfactory plan is to take up the different kinds of stairs successively, and as the housed string stair is one of the simplest, and at the same time an important one, we will begin with it. This class of stairs may be divided into two kinds. First, where the stair is between walls, that is, both strings are fastened to and supported by the walls; and second, where only one of the strings is fastened to the walls, and the other, the face, or outside string, is free.

The first is the cheaper, and is used very much in small cottages, and also as a rear stair in the better grade of houses. Of course, we find very often both of these stairs without the housed string. The treads are carried on a rough string, and the finished string is fastened to the treads and risers by nailing through it into the treads and risers, but, as this is very poor construction, we will not discuss it.

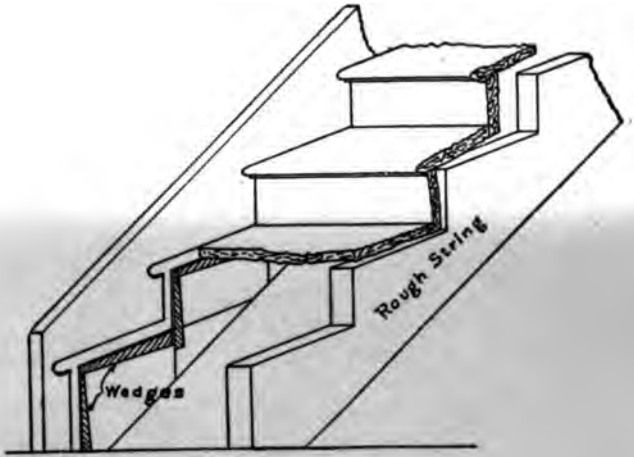


FIG. 1

As some may not understand the term "Housed String," we will explain. By housed string we mean that the string is notched out to receive the ends of the treads and risers. An examination of Fig. 1 will show clearly what is meant.

In the stair between two walls, which we are now considering, rough strings are unnecessary, unless the stair is over 2 feet 6 inches wide, when a rough string must be provided under the middle of the stair. The finished strings are fastened to the walls, and are more rigid than if a rough string was the means of support.

After determining the tread and riser lengths, proceed laying out the string. A little device very helpful in laying out a string is a gauge-board, as shown in Fig. 2, upon which has been cut the proper length of tread and riser to the pitch of the stair. In notching out the treads and risers the notches should be cut large enough to receive a small wedge below the tread and back of the riser. See Fig. 2. These are used to make a tight fit in front, where the treads and risers come against the edge of the notches. When the stairs is put together the wedges are covered with glue before being driven into place.

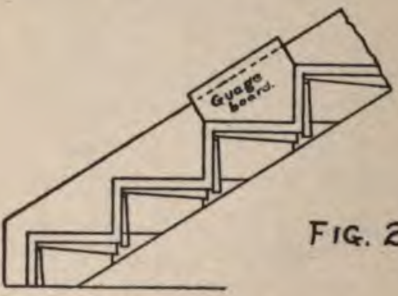


FIG. 2.

A closed string stair, that is, one between two walls, is built up against one of the walls before the second wall is built, which, when the stair is in place, is set up against it, and the string nearest to this wall is then fastened to the studding. If the stair is put in and lathing done afterwards pieces of inch stuff will have to be cut between the studding along the string to receive the ends of the lath. A better way, however, is to lath wall No. 1, before building the stair, then put in the stair, and when placing the studding of wall No. 2, leave the thickness of a lath clearance between the studs and the near string. Then lath this wall, shoving the lath through behind the string and nailing them below and above the stair. When this is done the string may be fastened to the studding by nailing through the string beneath the treads and risers.

Care must be taken, however, that the string lies well against the studding—even if necessary to put in thin blocking strips at each nailing place. Otherwise, there is danger of breaking the glue joint, where the treads and risers fit into the string.

A stair of this kind must always be put in before plastering and the plastering is finished down upon the string. The stair should be covered with paper and small strips of boards on the treads so as to preserve the unfinished wood work from the injurious effects of the plaster which might be spattered upon it. It is also a good idea to give the stair a coat of linseed oil before plastering as the wood work is then less easily affected by plaster.

There are several methods of joining the risers and treads. In Fig. 3 are shown the various methods of doing this. Some are considered better than others, but that is much a matter of opinion. At A in Fig. 3 is shown how the risers come down upon the tread and the tongue on the front side of the riser fits into a groove in the tread. If the fit is not good there will be a crack in the front of the riser, which will become more apparent as the stair becomes older. At G is another method. This is the very way when there is a rough string in under the middle of the stair. At F is a similar arrangement except that the riser goes down behind the tread. All of these joints should be nailed or fastened with wood screws.

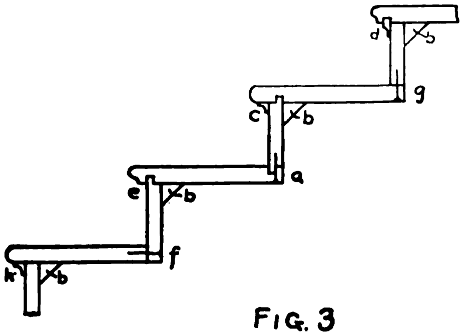


FIG. 3

At E and D, Fig. 3, are shown two ways of joining the tread and riser at the nosing. They are practically the same, the one at D having the moulding set into the groove, while at E a tongue is cut on the front of the riser to fit into the groove in the tread. In D and E there is the danger of having the nosing break off, because the tread, unless made of a rather thick piece of wood, may crack over the groove. In C and H are two more satisfactory methods. At C a tongue is cut on the back edge of the riser and the groove in the tread is as a result farther back from the front of the tread than in E and D. A small moulding is put under the nosing and there is little danger of the nosing breaking off. In G no groove is cut in the tread, so that the full strength of the tread is preserved. In this case, however, it is almost necessary to put a triangular strip, B, as shown, so as to fasten the tread and riser together. This strip may be put on with good results in all the cases, as it will stiffen up the work considerably.

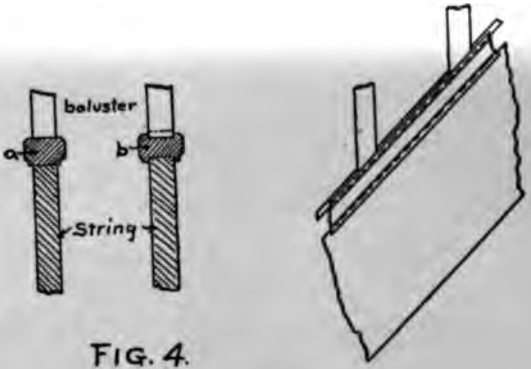


FIG. 4.

Now we will take up the stair which has one side open; that is, the string farthest from the wall, which is the face string. Fig. 4 shows a section and side elevation of this string. The treads and risers are housed the same as in the other stair, but the string must be made somewhat differently to fit the conditions. The strip A is placed upon the string to give it a better finish and may also be used to receive the lower ends of the balusters. These are beveled to fit the pitch of the string and fastened to the strip A. A better method is shown in B. The strip is grooved below to fit over the string, and above a groove is cut as wide as the balusters. These are set into the groove and a small strip as wide as the groove in B and a little thicker than the groove is deep, is fitted between the balusters. This gives a better finish to the joint between the string and balusters.

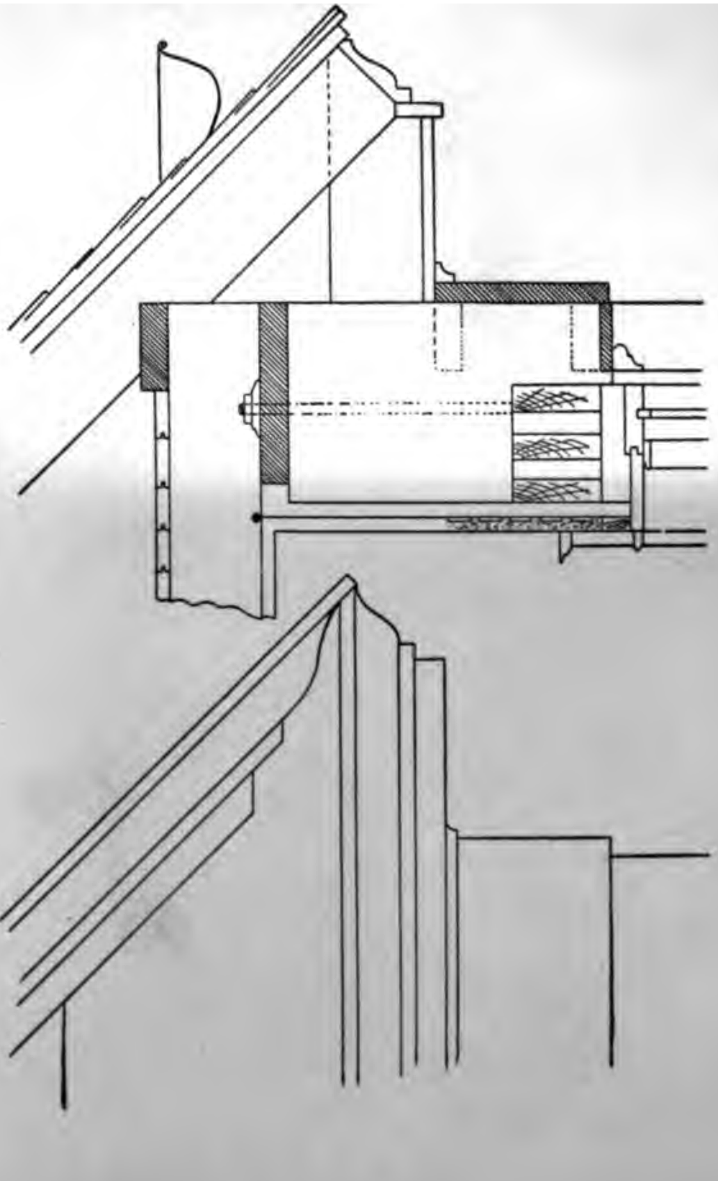
Painting a Shingle Roof

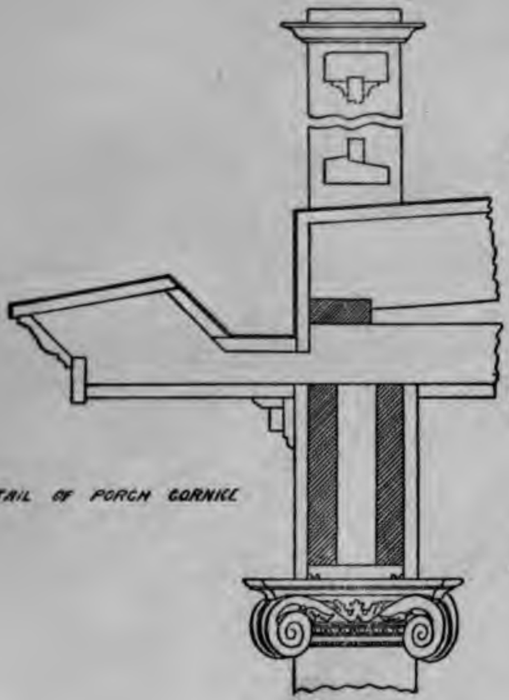
Question: I have just completed a shingle roofed house. These shingles were painted about two months ago with ready mixed red roofing paint two coats, the second being put on about three days later than the first. The water caught from this roof tastes so badly that it is unfit for drinking purposes. Please let me know what is the best way to go about to remedy it.

Answer: The ready mixed red roofing paint referred to is in all probability a paint made by mixing a mineral red or metallic paint, red oxide of iron, with linseed oil (probably more or less adulterated) with resin oil or mineral oil, since this is the usual composition of such paints. While such a paint would undoubtedly give a disagreeable taste to the water for some time and would discolor it to a certain extent, there is nothing poisonous about it, such as there would be in any white lead paint that could be used. As a rule, it

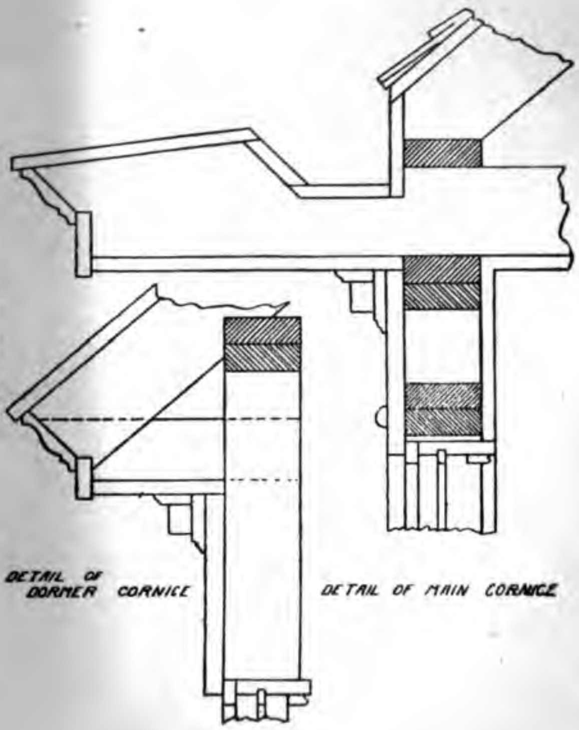
is better to avoid painting a shingle roof if the water from it is to be used for drinking purposes. Any additional coats of paint applied to this roof would add to the difficulty, and moreover the paint would find its way into the crevices between the shingles, causing little dams, which would hold back the water and rot the shingles. The present condition will probably disappear in the course of a month or two at most. When the paint becomes powdered on the surface it may be given a coat of hot linseed oil, but other than that we should not advise any treatment. Care should be taken in heating the oil to avoid fire. The best way is to put the can containing it into a large kettle of water, which is brought to a gentle boil over a slow fire. Cold raw linseed oil will answer the purpose, but will not penetrate the wood as well as hot oil. It might be well to add here that while dipping the shingles in creosote stain is found to preserve them, painted shingles do not last any longer than unpainted. Creosote, however, will give a very disagreeable taste to water taken from a roof where such stains are used.

[illegible]



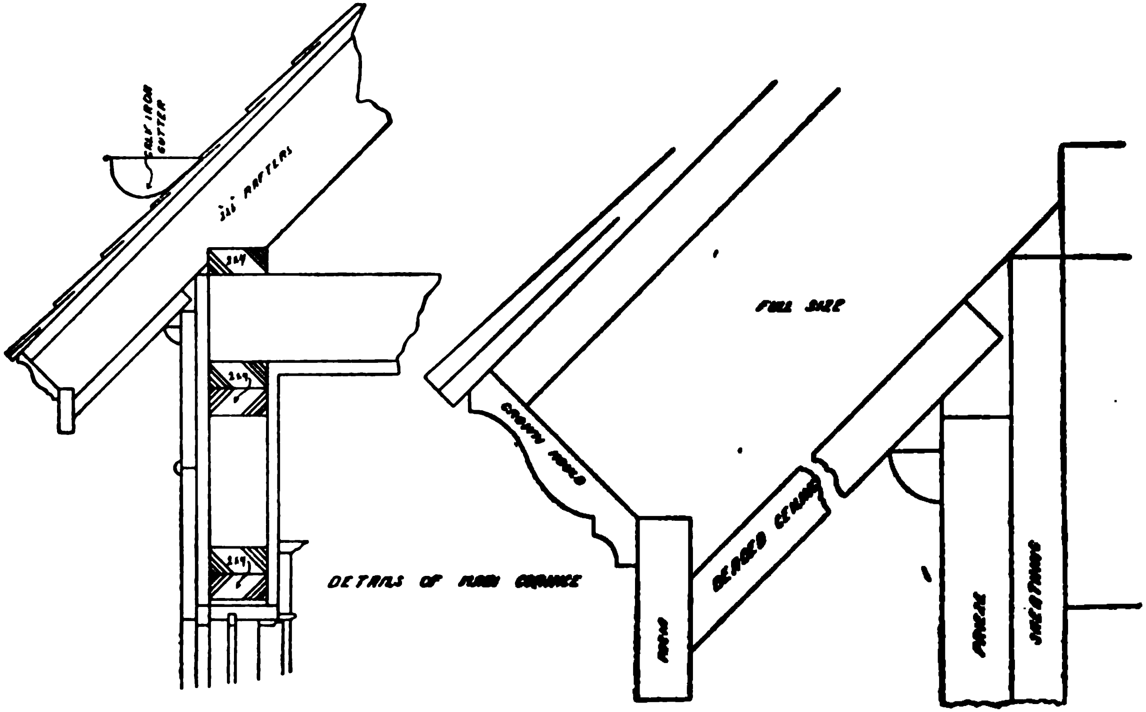


DETAIL OF PORCH CORNICE

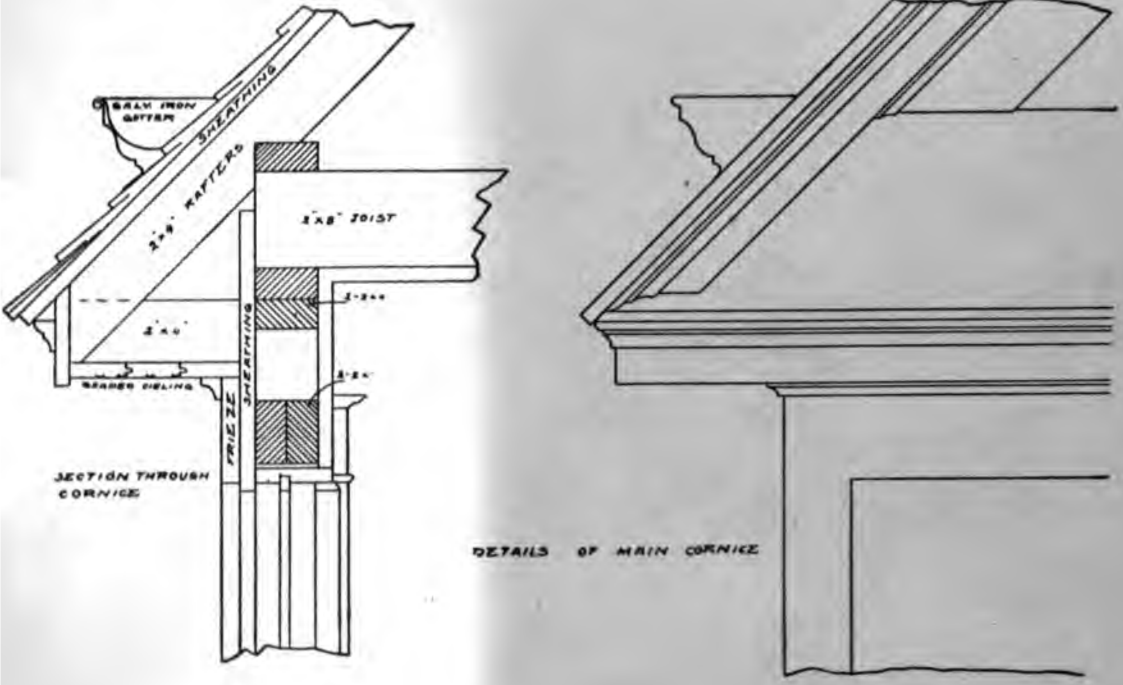


DETAIL OF DORMER CORNICE

DETAIL OF MAIN CORNICE



DETAILS OF MAIN CORNICE



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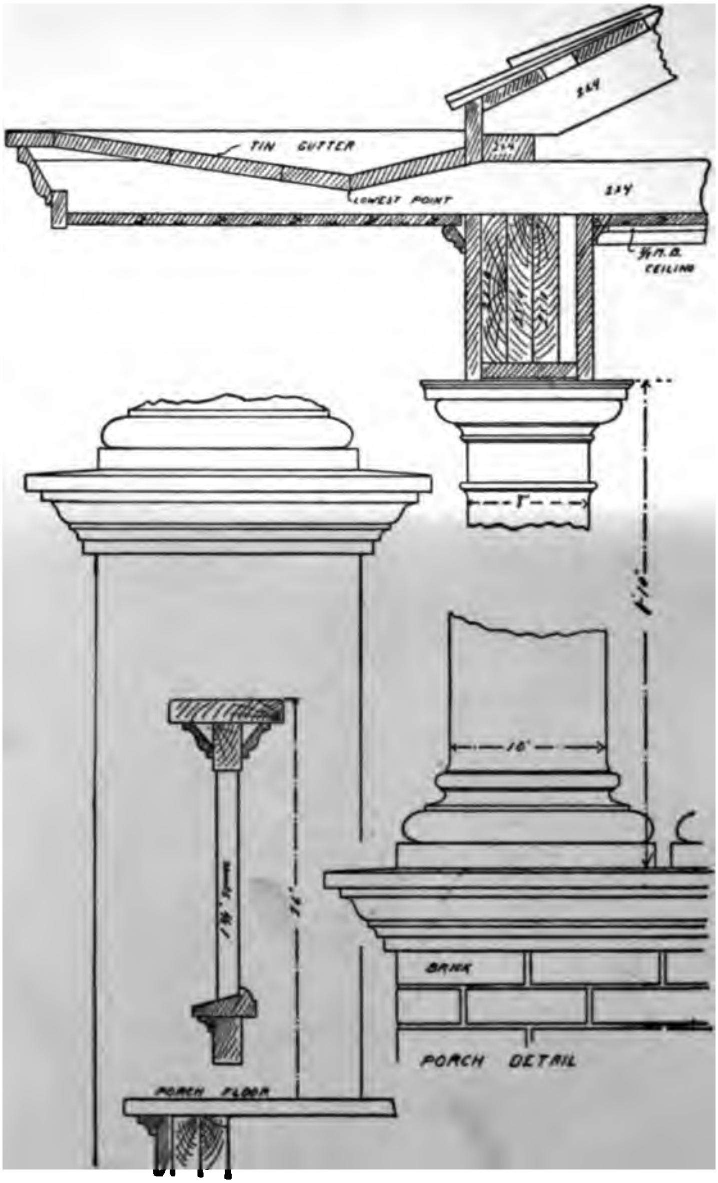
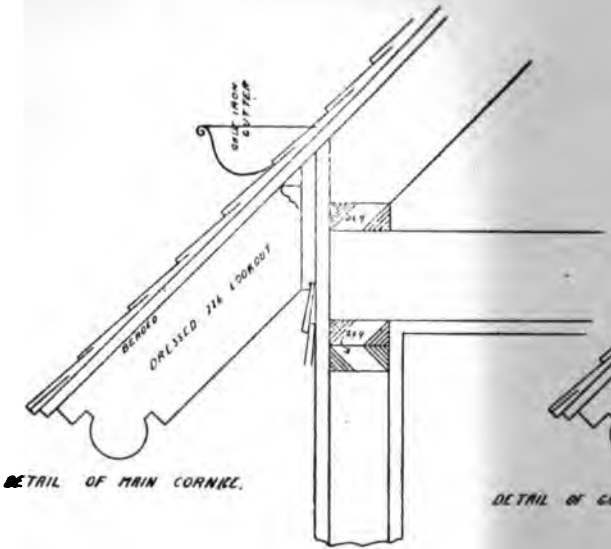
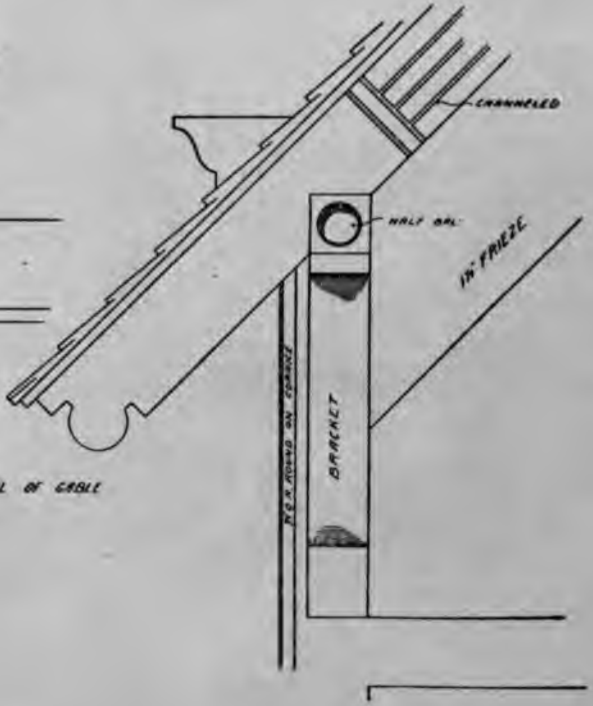
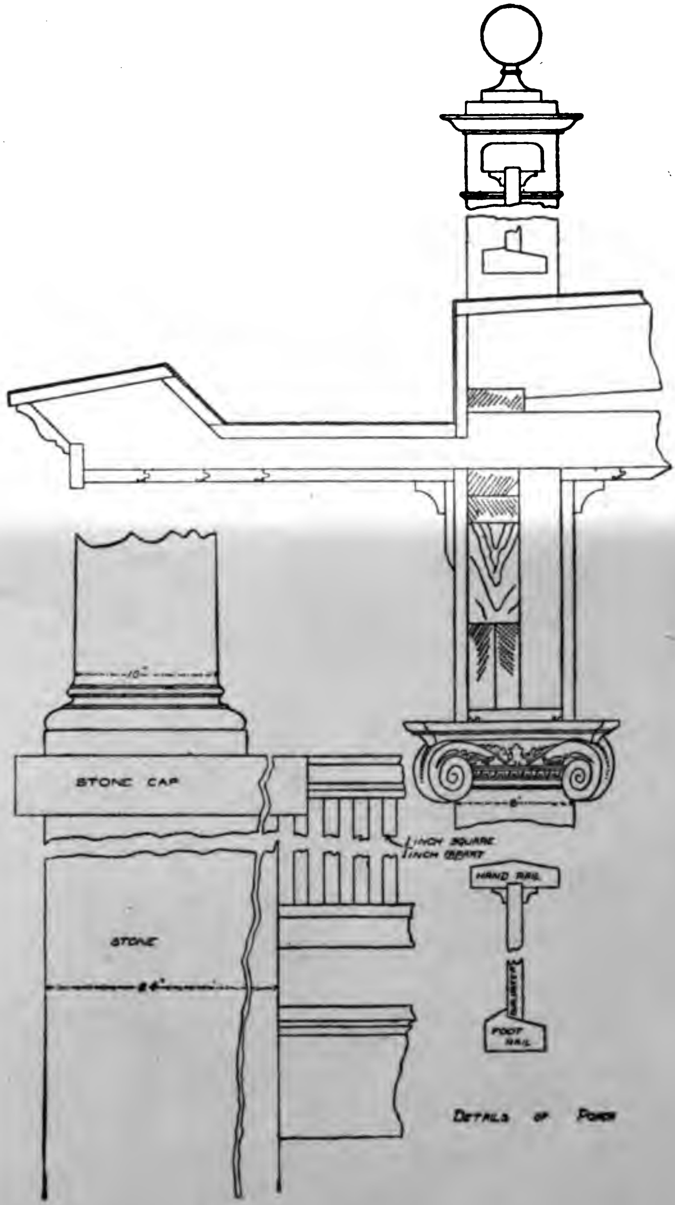

TIN GUTTER
2x4
2x4
LOWEST POINT
2x4
3/4 M.B. CEILING
1'
1'10"
10"
1 3/4" Square
26"
PORCH FLOOR
BRICK
PORCH DETAIL



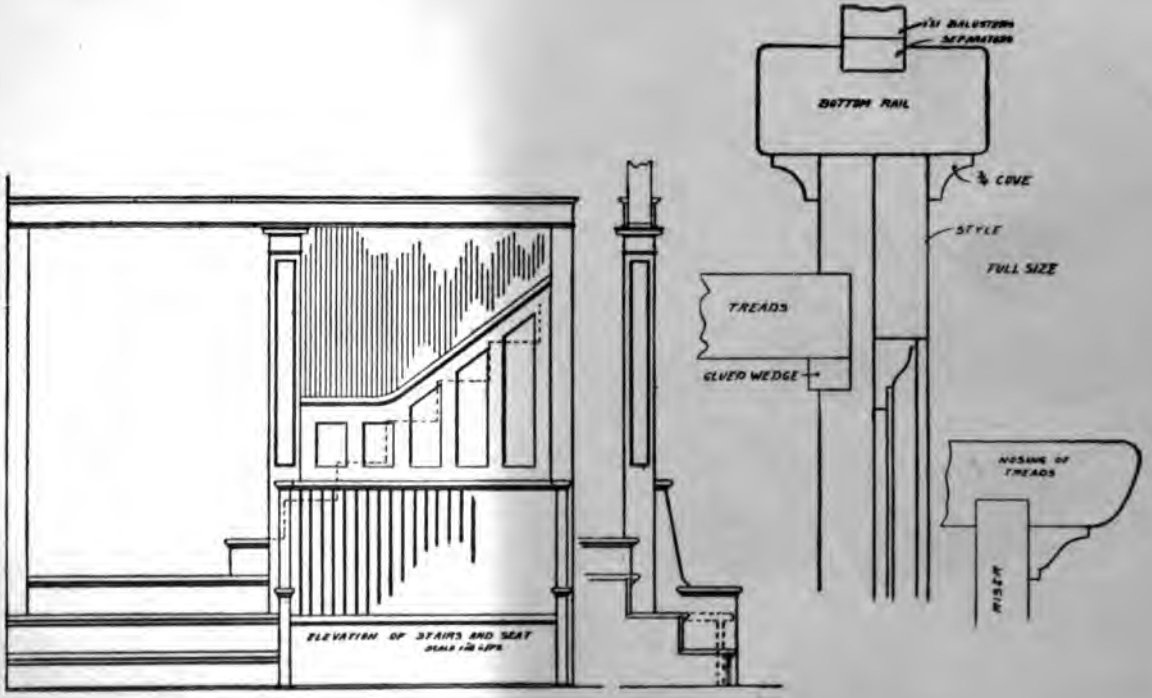
DETAIL OF MAIN CORNICE.

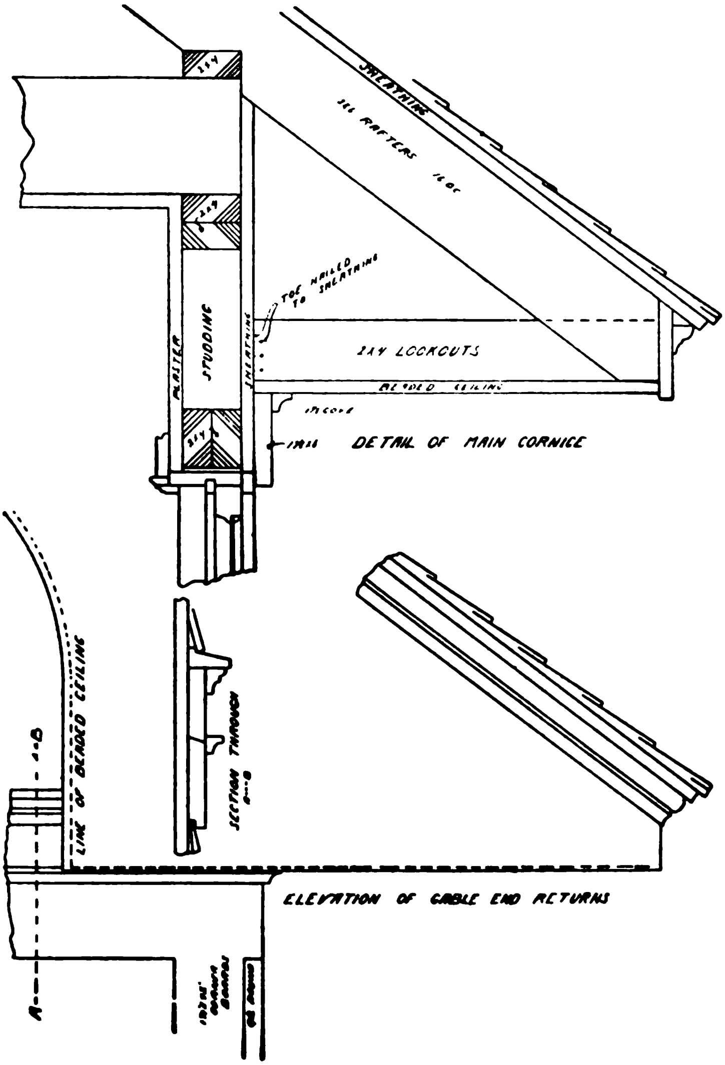


DETAIL OF GABLE



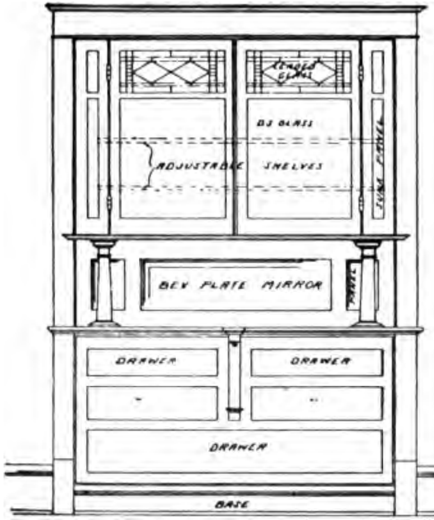
DETAILS OF PORCH


ELEVATION OF STAIRS AND SEAT
SCALE
BALUSTERS
SEPARATORS
BOTTOM RAIL
¾ COVE
STYLE
FULL SIZE
TREADS
GLUED WEDGE
NOSING OF TREADS
RISER

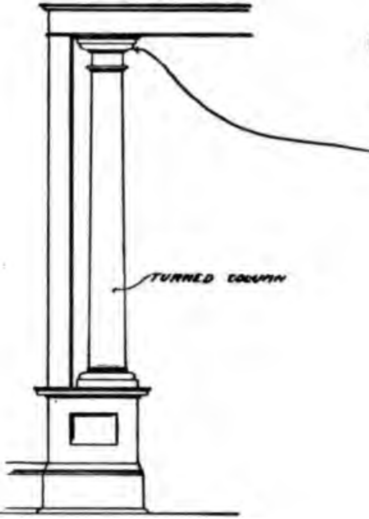


DETAIL OF MAIN CORNICE

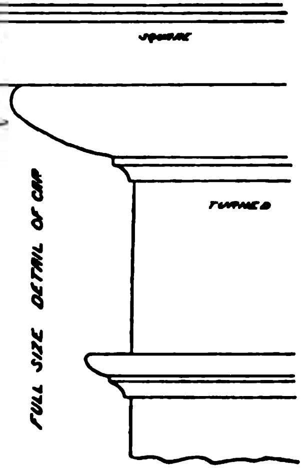
ELEVATION OF GABLE END RETURNS



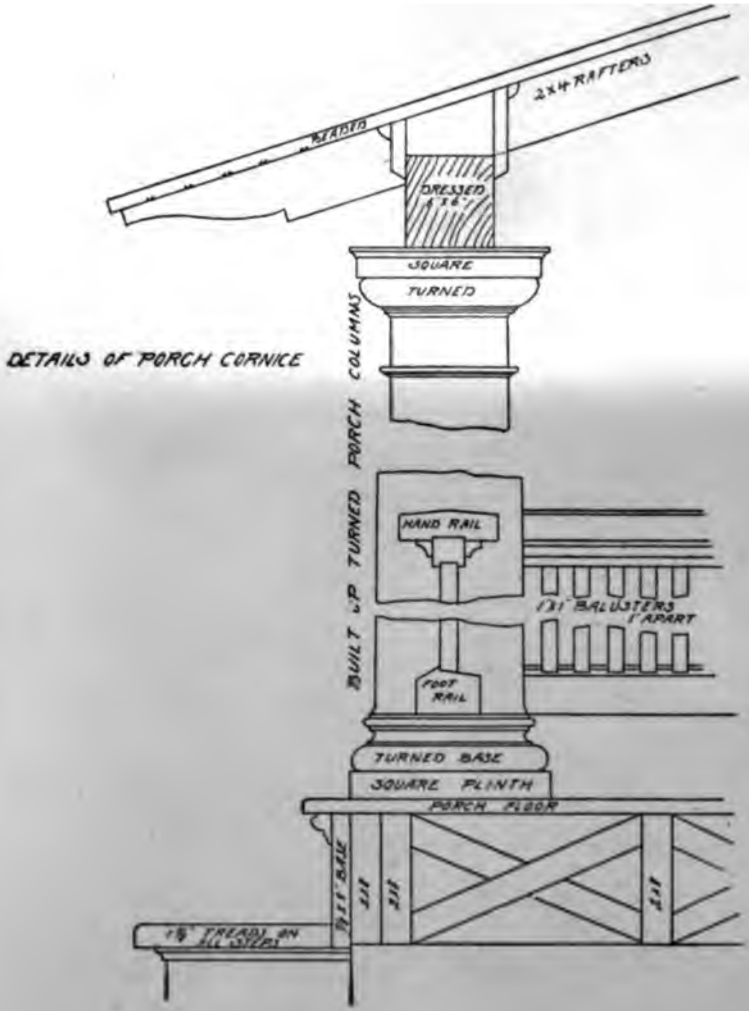
DESIGN OF CHINA CLOSET

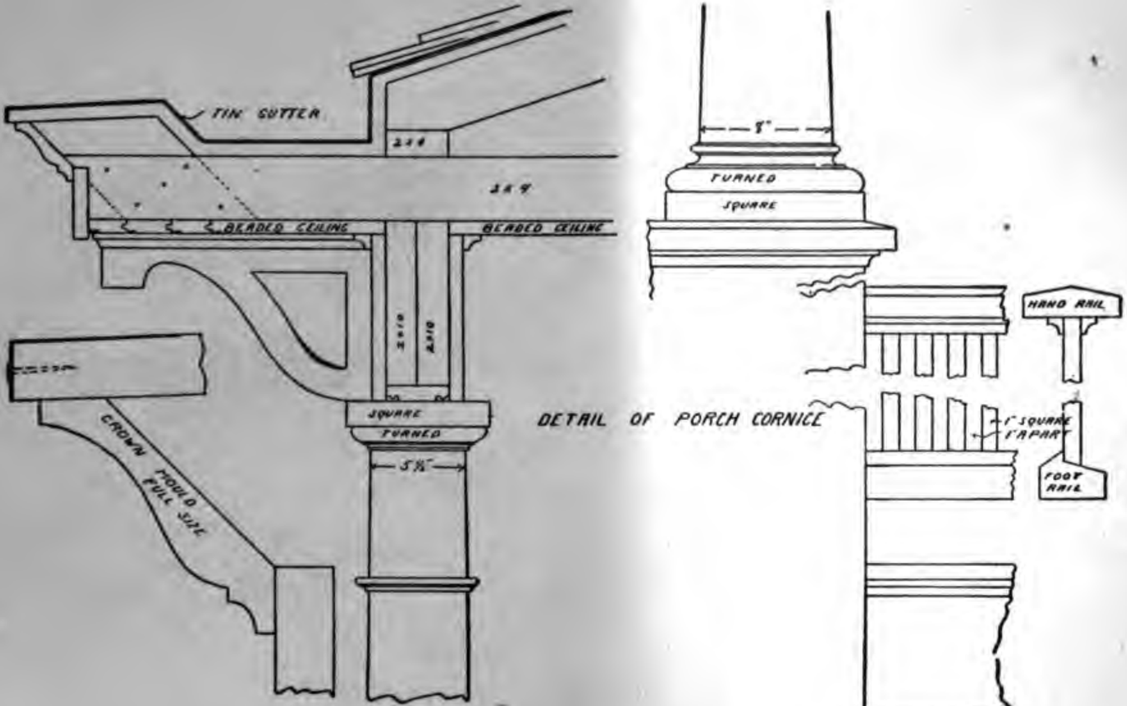


DESIGN OF ARCHWAY

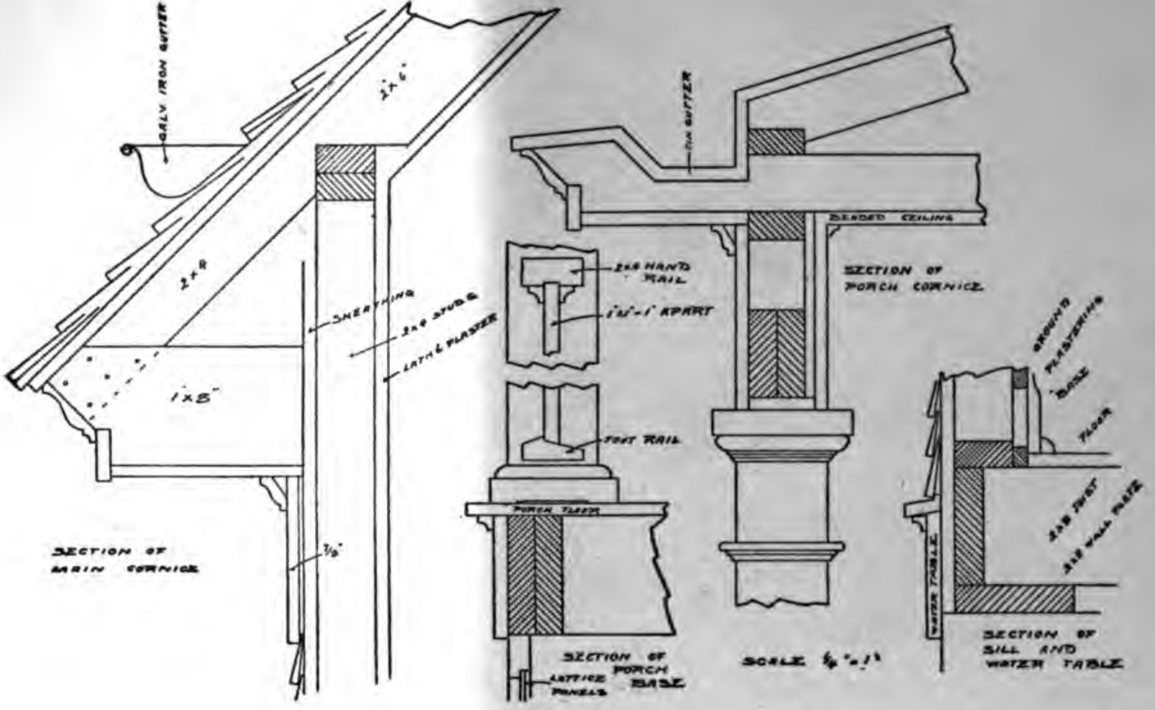


FULL SIZE DETAIL OF CAP


BEADED
2x4 RAFTERS
DRESSED 4"x6"
SQUARE
TURNED
DETAILS OF PORCH CORNICE
BUILT UP TURNED PORCH COLUMNS
HAND RAIL
1"x1" BALUSTERS 1" APART
FOOT RAIL
TURNED BASE
SQUARE PLINTH
PORCH FLOOR
⅞"x8" BASE
2x8
2x8
2x8
1⅝" TREADS ON ALL STEPS



DETAIL OF PORCH CORNICE



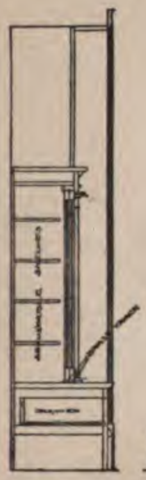
SECTION OF MAIN CORNICE

SECTION OF PORCH BASE

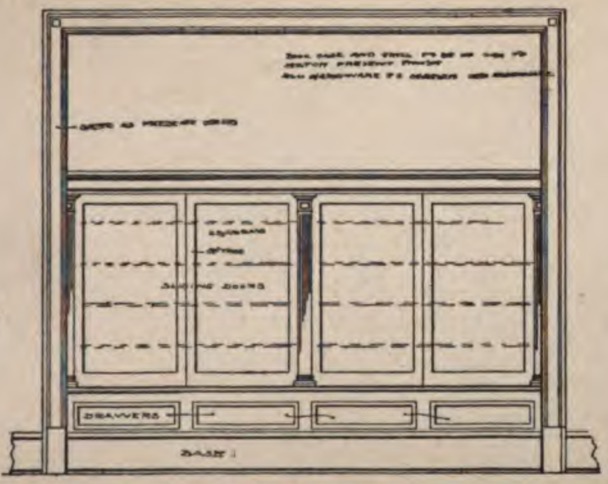
SCALE ¾"=1'

SECTION OF PORCH CORNICE

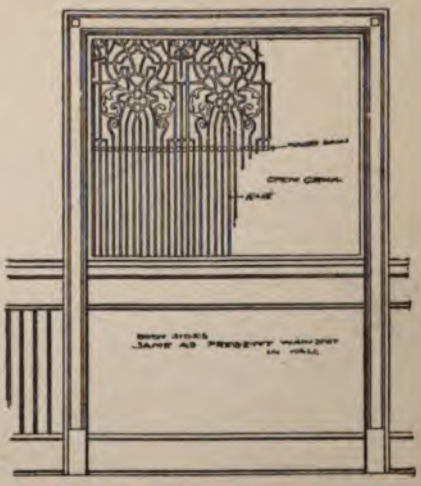
SECTION OF SILL AND WATER TABLE



SECTION



ELEVATION OF BOOK CASE



DESIGN OF GRILL

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Practical House Plans

WE ILLUSTRATE IN THIS BOOK the perspective view and floor plans of 50 low and medium-priced houses. In the preparation of this work great care has been exercised in the selection of original, practical and attractive house designs, such as seventy-five to ninety per cent of the people to-day wish to build. In drawing these plans special effort has been made to provide for the MOST ECONOMICAL CONSTRUCTION, thereby giving the home builder and contractor the benefit of the saving of many dollars; for in no case have we put any useless expense upon the building simply to carry out some pet idea. Every plan illustrated will show, by the complete working plans and specifications, that we give you designs that will work out to the best advantage and will give you the most for your money; besides every bit of space has been utilized to the best advantage.

$50.00 PLANS FOR ONLY $5.00 This department has for its foundation the best equipped architectural establishment ever maintained for the purpose of furnishing the public with complete working plans and specifications at the remarkably low price of only $5.00 per set. Every plan we illustrate has been designed by a licensed architect, who stands at the head of his profession in this particular class of work and has made a specialty of low and medium-priced houses. The price usually charged for this work is from $50.00 to $75.00.

WHAT WE GIVE YOU The first question you will ask is, "What do we get in these complete working plans and specifications? Of what do they consist? Are they the cheap printed plans on tissue paper without details or specifications?" We do not blame you for wishing to know what you will get for your money.

BLUE PRINTED WORKING PLANS The plans we send out are the regular blue printed plans, drawn one-quarter inch scale to the foot, showing all the elevations, floor plans and necessary interior details. All of our plans are printed by electricity on an electric circular blue-printing machine, and we use the very best grade of electric blue-printing paper; every line and figure showing perfect and distinct.

FOUNDATION AND CELLAR PLANS This sheet shows the shape and size of all walls, piers, footings, posts, etc., and of what materials they are constructed; shows the location of all windows, doors, chimneys, ash-pits, partitions, and the like. The different wall sections are given, showing their construction and measurements from all the different points.

FLOOR PLANS These plans show the shape and size of all rooms, halls and closets; the location and size of all doors and windows; the position of all plumbing fixtures, gas lights, registers, pantry work, etc., and all the measurements that are necessary are given.

ELEVATIONS A front, right, left and rear elevation are furnished with all the plans. These drawings are complete and accurate in every respect. They show the shape, size and location of all doors, windows, porches, cornices, towers, bays, and the like; in fact, give you an exact scale picture of the house as it should be at completion. Full wall sections are given showing the construction from foundation to roof, the height of stories between the joists, height of plates, pitch of roof, etc.

ROOF PLAN This plan is furnished where the roof construction is at all intricate. It shows the location of all hips, valleys, ridges, decks, etc. All the above drawings are made to scale one-quarter inch to the foot.

DETAILS All necessary details of the interior work, such as door and window casings and trim, base, stools, picture moulding, doors, newel posts, balusters, rails, etc., accompany each set of plans. Part is shown in full size, while some of the larger work, such as stair construction, is drawn to a scale of one and one-half inch to the foot. These blue prints are substantially and artistically bound in cloth and heavy water-proof paper, making a handsome and durable covering and protection for the plans.

SPECIFICATIONS The specifications are typewritten on Lakeside Bond Linen paper and are bound in the same artistic manner as the plans, the same cloth and water-proof paper being used. They consist of from about sixteen to twenty pages of closely typewritten matter, giving full instructions for carrying out the work. All directions necessary are given in the clearest and most explicit manner, so that there can be no possibility of a misunderstanding.

BASIS OF CONTRACT The working plans and specifications we furnish can be made the basis of contract between the home builder and the contractor. This will prevent mistakes, which cost money, and they will prevent disputes which are unforeseen and never settled satisfactorily to both parties. When no plans are used the contractor is often obliged to do some work he did not figure on, and the home builder often does not get as much for his money as he expected, simply because there was no basis on which to work and upon which to base the contract.

NO MISUNDERSTANDING CAN ARISE when a set of our plans and specifications is before the contractor and the home builder, showing the interior and exterior construction of the house as agreed upon in the contract. Many advantages may be claimed for the complete plans and specifications. They are time savers and, therefore, money savers. Workmen will not have to wait for instructions when a set of plans is left on the job. They will prevent mistakes in cutting lumber, in placing door and window frames, and in many other places where the contractor is not on the work and the men have received only partial or indefinite instructions. They also give instructions for the working of all material to the best advantage.

FREE PLANS FOR FIRE INSURANCE ADJUSTMENT You take every precaution to have your house covered by insurance; but do you make any provision for the adjustment of the loss, should you have a fire? There is not one man in ten thousand who will provide for this embarrassing situation. You can call to mind instances in your own locality where settlements have been delayed because the insurance companies wanted some proof which could not be furnished. They demand proof of loss before paying insurance money, and they are entitled to it. We have provided for this and have inaugurated the following plan, which cannot but meet with favor by whoever builds a house from our plans.

IMMEDIATELY UPON RECEIPT OF INFORMATION from you that your house has been destroyed by fire, either totally or partially, we will forward you, free of cost, a duplicate set of plans and specifications, and in addition we will furnish an affidavit giving the number of the design and the date when furnished, to be used for the adjustment of the insurance.

WITHOUT ONE CENT OF COST TO YOU and without one particle of trouble. We keep a record of the number of the house design and the date it was furnished, so that, in time of loss, all it will be necessary for you to do is to drop us a line and we will furnish the only reliable method of getting a speedy and satisfactory adjustment. This may be the means of saving you hundreds of dollars, besides much time and worry.

OUR LIBERAL PRICES Many have marveled at our ability to furnish such excellent and complete working plans and specifications at such low prices. We do not wonder at this, because we charge but $5.00 for a more complete set of working plans and specifications than you would receive if ordered in the ordinary manner, and when drawn especially for you, at a cost of from fifty to seventy-five dollars. On account of our large business and unusual equipment, and owing to the fact that WE DIVIDE THE COST of these plans among so many, it is possible for us to sell them at these low prices. The margin of profit is very close, but it enables us to sell thousands of sets of plans, which save many times their cost to both the owner and the contractor in erecting even the smallest dwelling.

OUR GUARANTEE Perhaps there are many who feel that they are running some risk in ordering plans at a distance. We wish to assure our customers that there is no risk whatever. If, upon receipt of these plans, you do not find them exactly as represented, if you do not find them complete and accurate in every respect, if you do not find them as well prepared as those furnished by any architect in the country, or any that you have ever seen, we will refund your money upon the return of the plans from you in perfect condition. All of our plans are prepared by architects standing at the head of their profession, and the standard of their work is the very highest. We could not afford to make this guarantee if we were not positive that we were furnishing the best plans put out in this country, even though our price is not more than one-seventh to one-tenth of the price usually charged.

BILL OF MATERIAL We do not furnish a bill of material. We state this here particularly, as some people have an idea that a bill of material should accompany each set of plans and specifications. In the first place, our plans are gotten up in a very comprehensive manner, so that any carpenter can easily take off the bill of material without any difficulty. We realize that there are hardly two sections of the country where exactly the same kinds of materials are used, and, moreover, a bill which we might furnish would not be applicable in all sections of the country. We furnish plans and specifications for houses which are built as far north as the Hudson Bay and as far south as the Gulf of Mexico. They are built upon the Atlantic and Pacific Coasts, and you can also find them in Australia and South Africa. Each country and section of a country has its peculiarities as to sizes and qualities; therefore, it would be useless for us to make a list that would not be universal. Our houses, when completed, may look the same whether they are built in Canada or Florida, but the same materials will not be used, for the reason that the customs of the people and the climatic conditions will dictate the kind and amount of materials to be used in their construction.

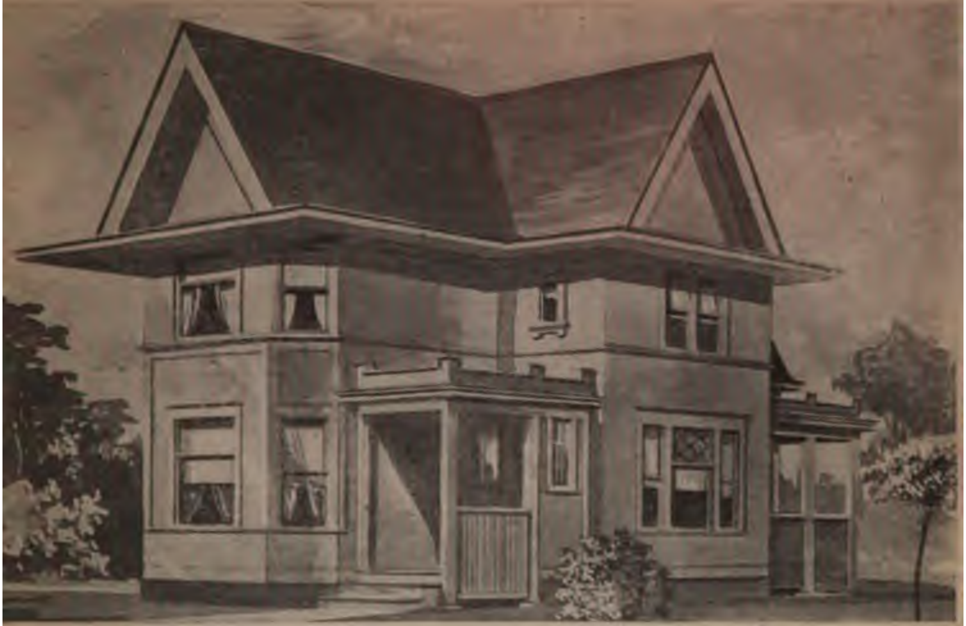
ESTIMATED COST It is impossible for anyone to estimate the cost of a building and have the figures hold good in all sections of the country. We do not claim to be able to do it. The estimated cost of the houses we illustrate is based on the most favorable conditions in all respects and includes everything but the plumbing and heating. We are not familiar with your local conditions, and, should we claim to know the exact cost of a building in your locality, a child would know that our statement was false. We leave this matter in the hands of the reliable contractors, for they, and they alone, know your local conditions.

WE WISH TO BE FRANK WITH YOU and therefore make no statement that we cannot substantiate in every respect. If a plan in this book pleases you; if the arrangement of the rooms is satisfactory, and if the exterior is pleasing and attractive, then we make this claim—that it can be built as cheaply as if any other architect designed it, and we believe cheaper.

WE HAVE STUDIED ECONOMY in construction, and our knowledge of all the material that goes into a house qualifies us to give you the best for your money. We give you a plan that pleases you, one that is attractive, and one where every foot of space is utilized at the least possible cost. Can any architect do more, even at seven to ten times the price we charge you for plans?

REVERSING PLANS We receive many requests from our patrons for plans exactly according to the designs illustrated, with the one exception of having them reversed or placed in the opposite direction. It is impossible for us to make this change and draw new plans, except at a cost of about eight times our regular price. We see no reason why our regular plans will not answer your purpose. Your carpenter can face the house exactly as you wish it, and the plans will work out as well facing in one direction as in another. We can, however, if you wish, and so instruct us, make you a reversed blue print and furnish it at our regular price; but in that case all the figures and letters will be reversed and, therefore, liable to cause as much confusion as if your carpenter reversed the plan himself while constructing the house.

WE WOULD ADVISE however, in all cases where the plan is to be reversed, and there is the least doubt about the contractor not being able to work from the plans as we have them, that two sets of blue prints be purchased, one regular and the other reversed, and in such cases we will furnish two sets of blue prints and one set of specifications for only fifty per cent added to the regular cost, making the $5.00 plan cost only $7.50.



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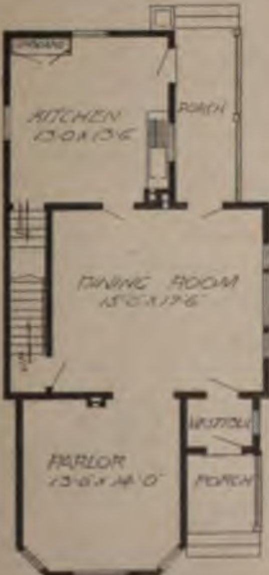
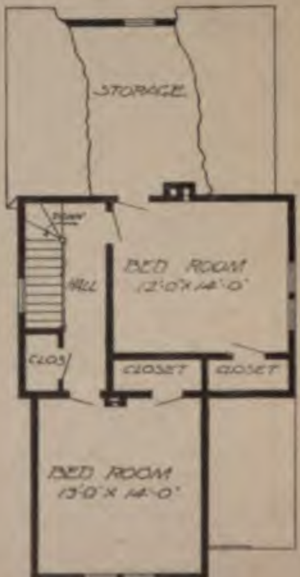


First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

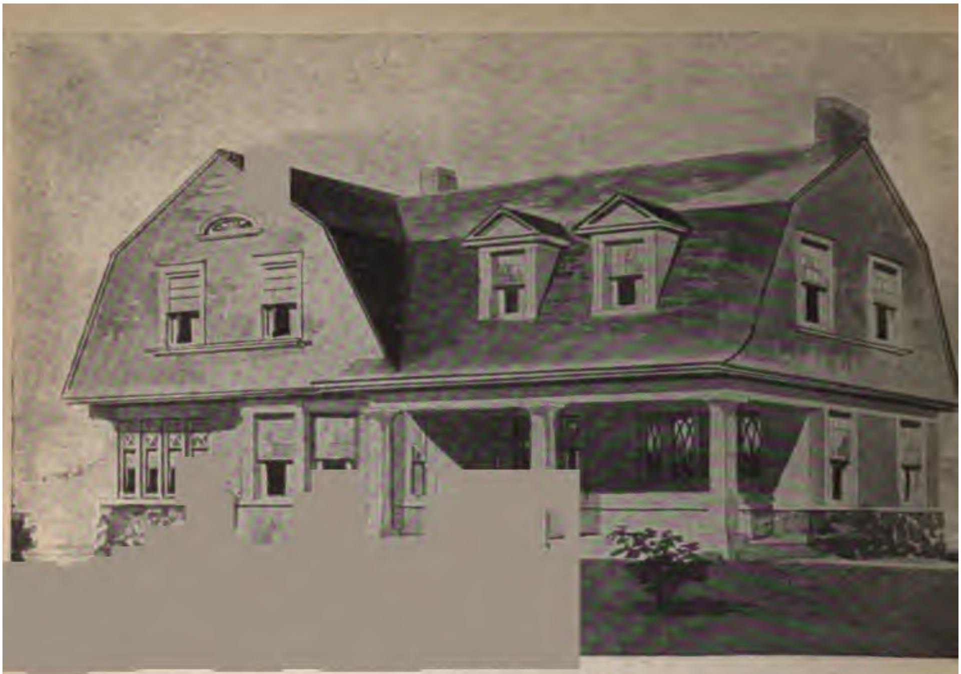
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 22 feet; length, 44 feet 6 inches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations, wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,550.00 to about $1,750.00, according to the locality in which it is built.



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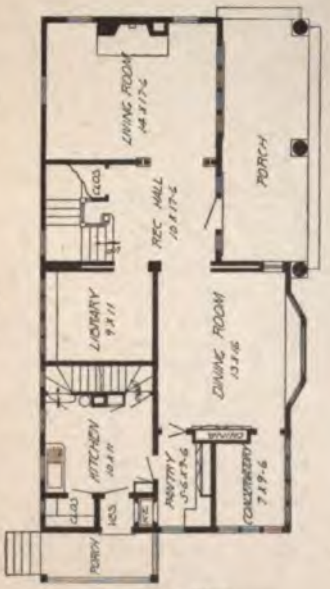
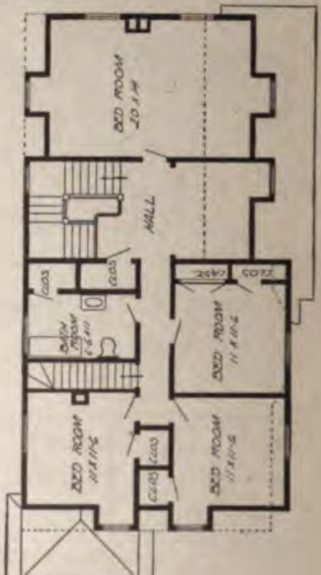


First Floor Plan

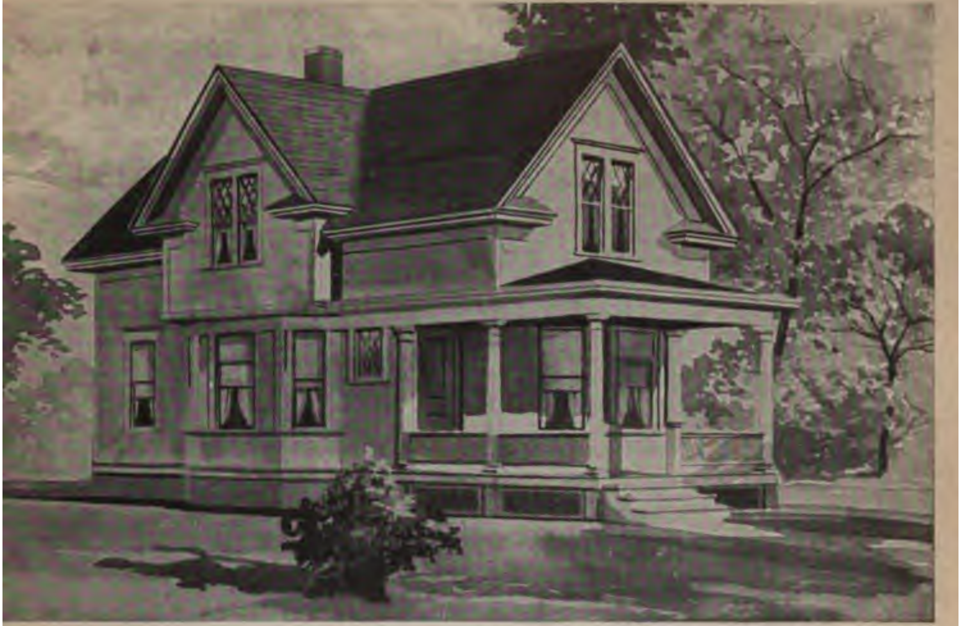


Second Floor Plan

Size: Width, 52 feet 6 inches; length, 27 feet, exclusive of porches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $3,000.00 to about $3,250.00, according to the locality in which it is built.



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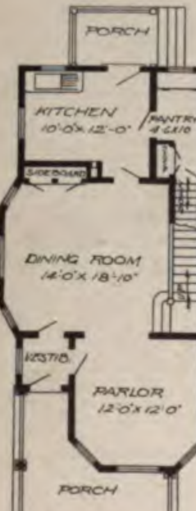
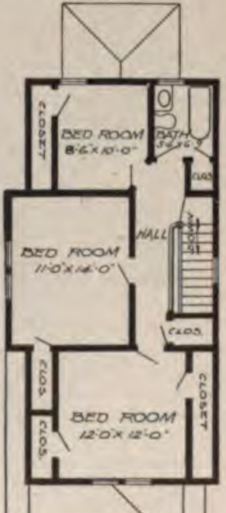


First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

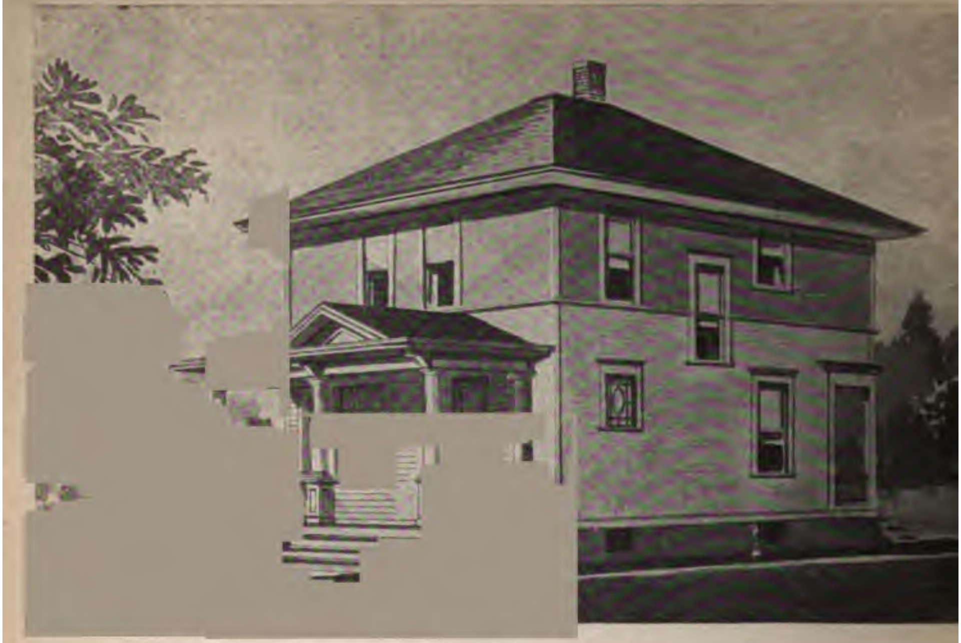
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 19 feet 10 inches; length, 38 feet, exclusive of porches

Blue prints consist of basement plan; first and second floor plans; front, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,550.00 to about $2,800.00, according to the locality in which it is built.



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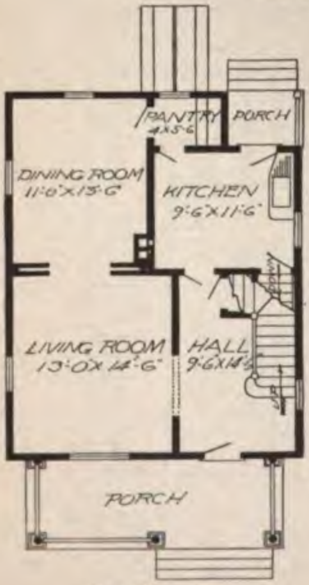
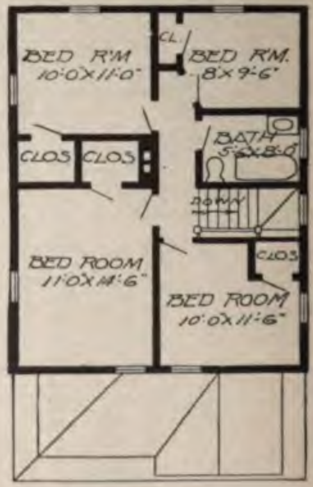


First Floor Plan

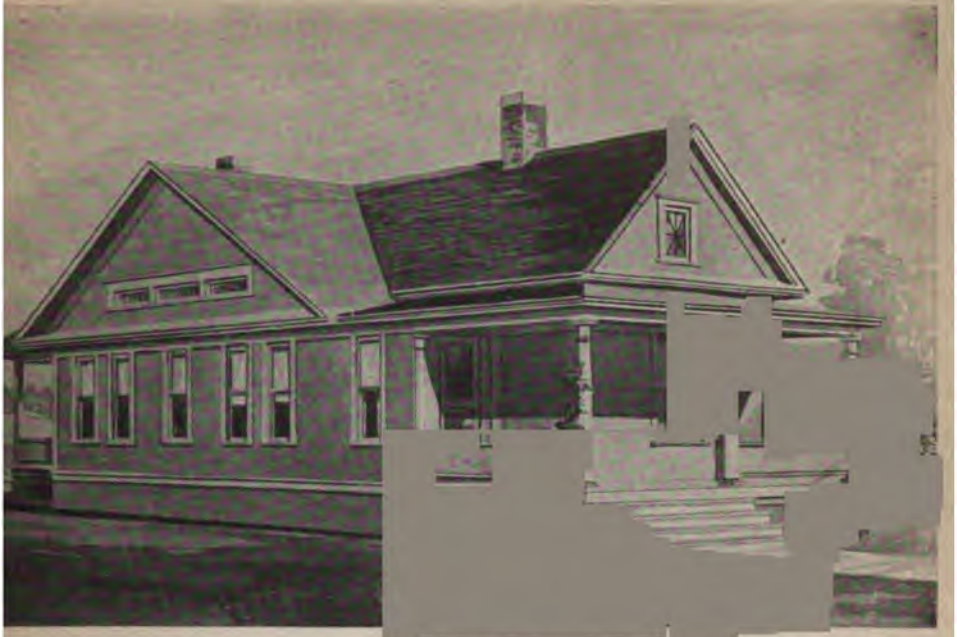


Second Floor Plan

Size: Width, 24 feet; length, 30 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. *Specifications consist of about twenty pages of typewritten matter.*

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,950.00 to about $2,150,00, according to the locality in which it is built.



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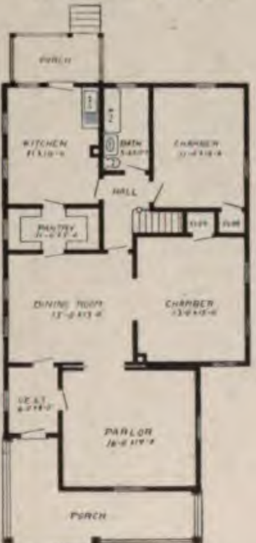


PRICE
of Blue
Prints, together with
a complete
set of typewritten
specifications is

ONLY

$5.00

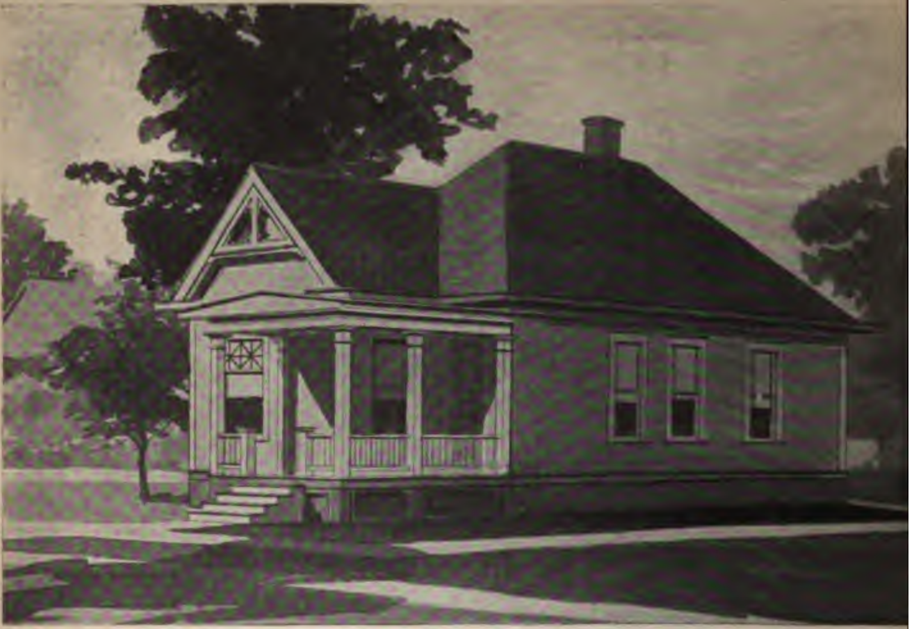
We mail
Plans and
Specifications the
same day
order is received.

Floor Plan

Size: Width, 29 feet 6 inches; length, 49 feet, exclusive of porches.

Blue prints consist of basement plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,650.00 to about $1,800.00, according to the locality in which it is built.



Design No. 2002

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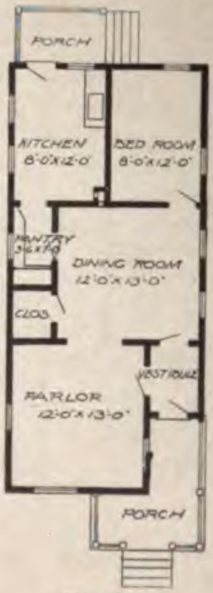
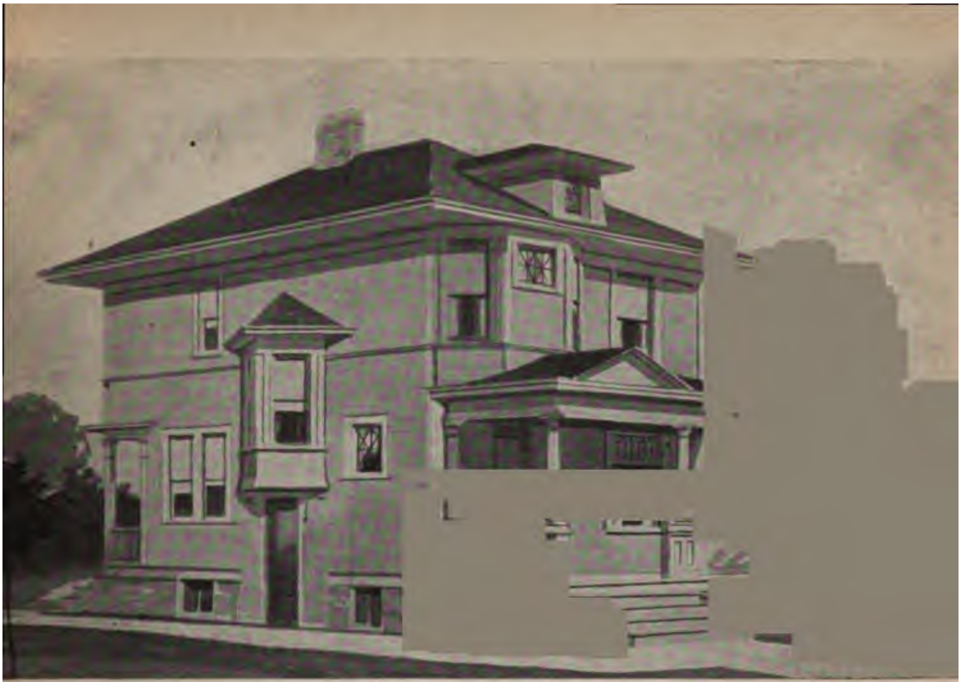


Floor Plan

Size: Width, 18 feet; length, 39 feet, exclusive of porches

Blue prints consist of foundation plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. *Specifications consist of about fifteen pages of typewritten matter.*

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $850.00 to about $1,000.00, according to the locality in which it is built.



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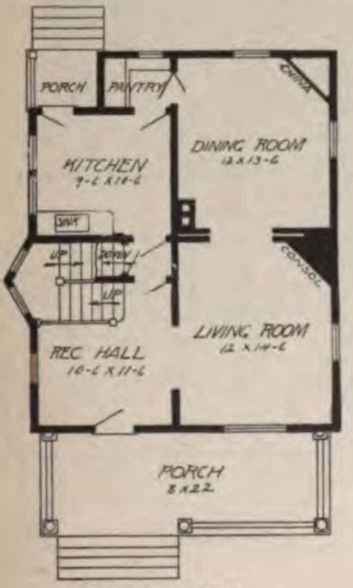
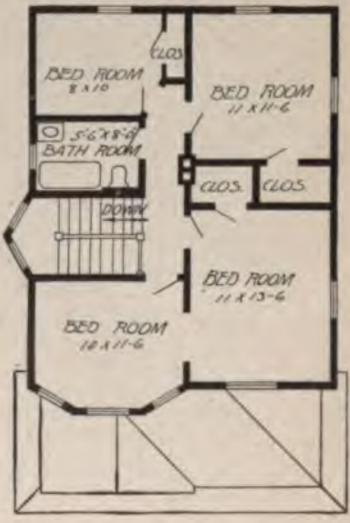


First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

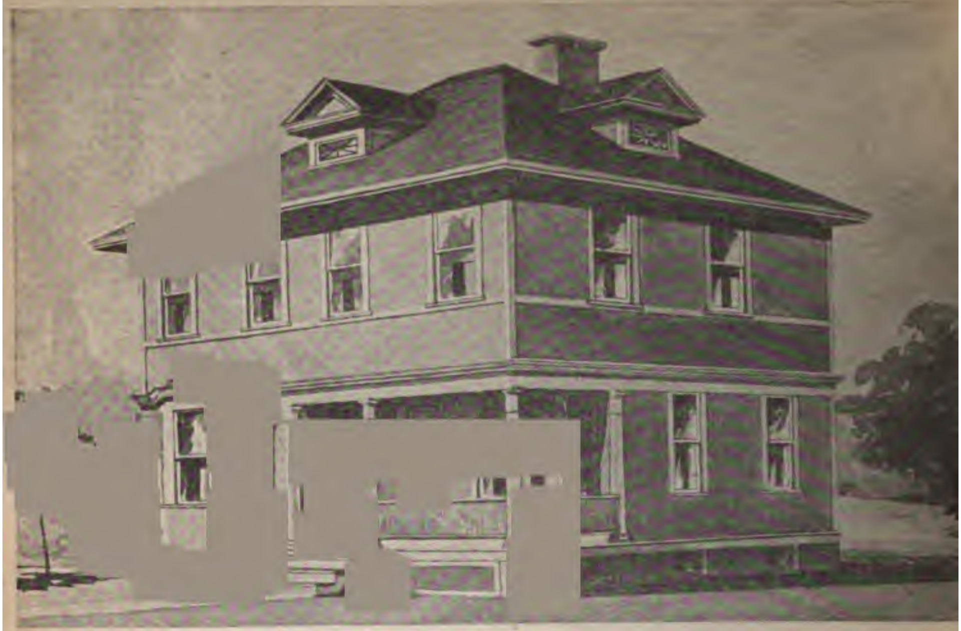
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 24 feet; length, 30 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,550.00 to about $1,750.00, according to the locality in which it is built.



Design No. 2039

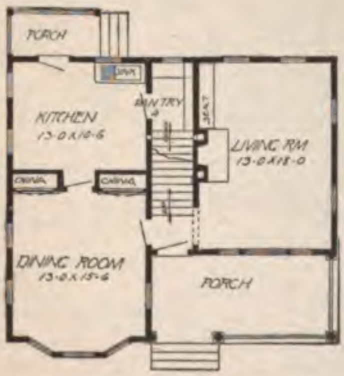
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

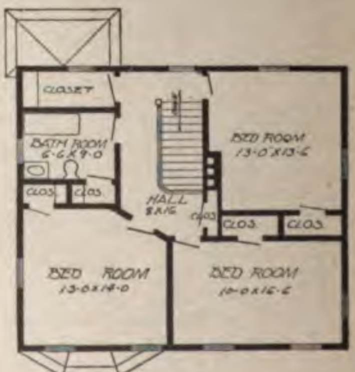
ONLY

$5.00

We mail Plans and Specifications the same day order is received.



First Floor Plan

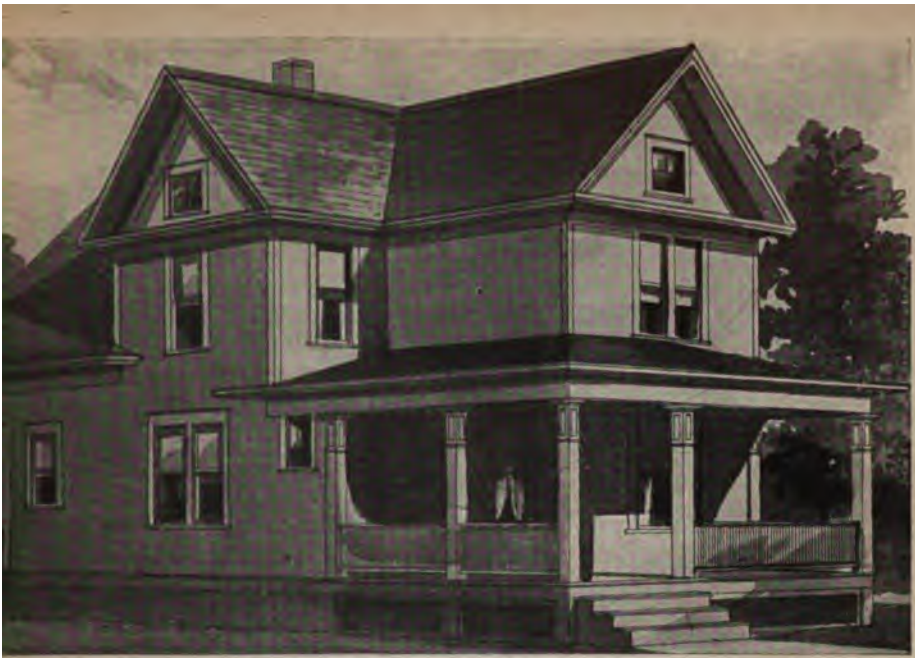


Second Floor Plan

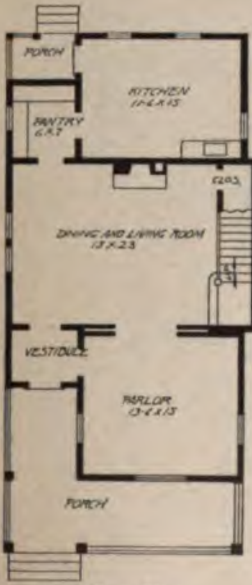
Size: Width, 32 feet; length, 27 feet 6 inches, exclusive of porches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about *twenty pages of typewritten matter.*

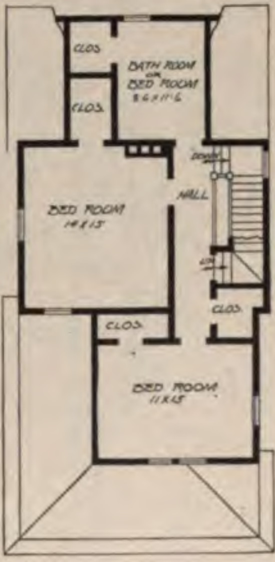
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,750.00 to about $1,950.00, according to the locality in which it is built.



Design No. 2022



First Floor Plan



Second Floor Plan

PRICE
of Blue
Prints, together with
a complete
set of typewritten
specifications is

ONLY

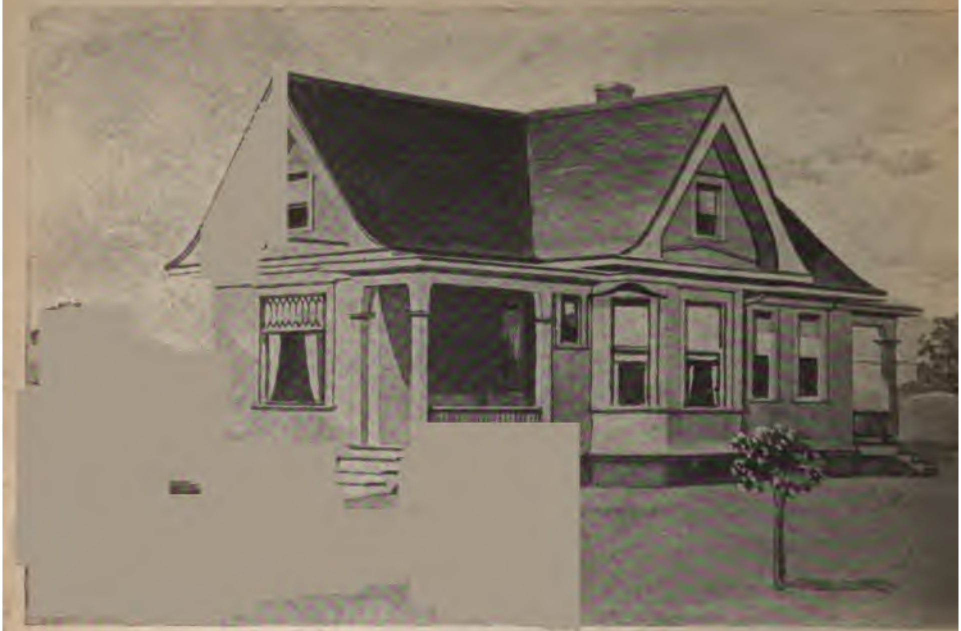
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 24 feet; length, 43 feet, exclusive of porches

Blue prints consist of cellar and foundation plan; first and second floor plans; front, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,850.00 to about $2,100.00, according to the locality in which it is built.



Design No. 2016

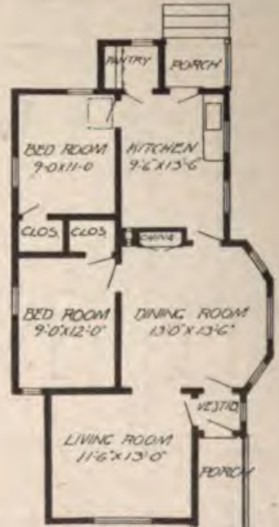
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

We mail Plans and Specifications the same day order is received.

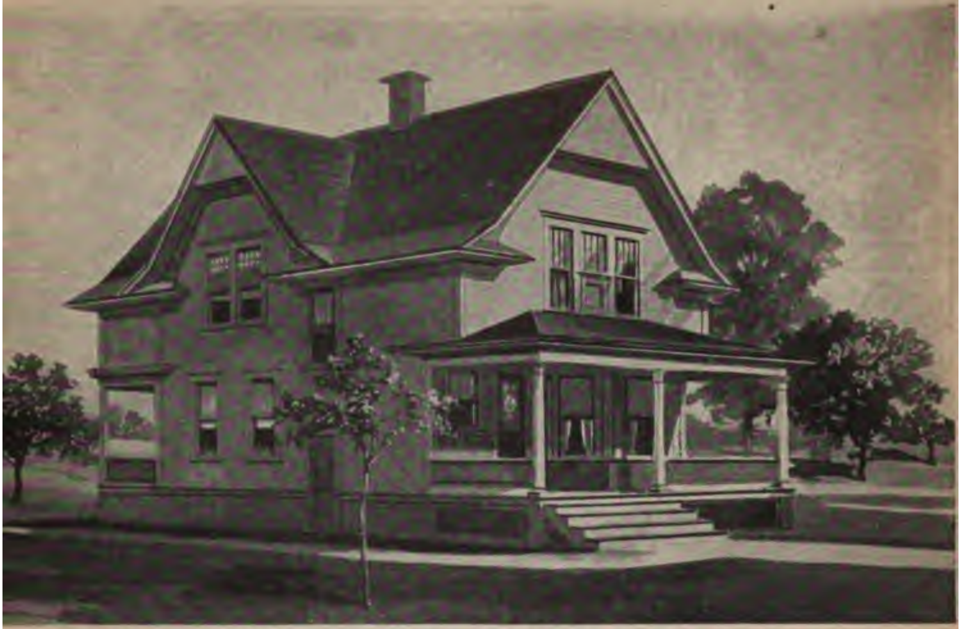


Floor Plan

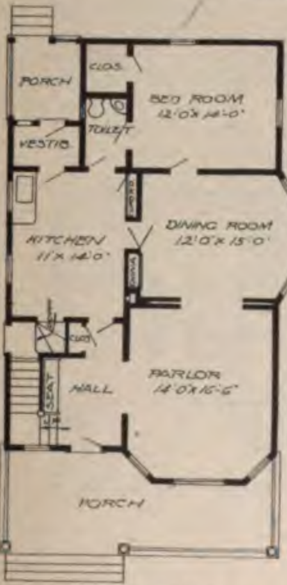
Size: Width, 24 feet; length, 44 feet 6 inches, exclusive of porch

Blue prints consist of foundation plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

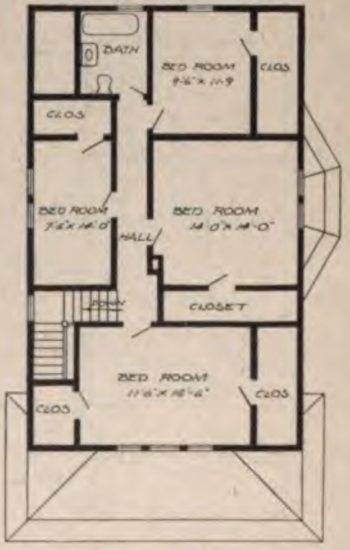
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,250.00 to about $1,400.00, according to the locality in which it is built.



Design No. 2005



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

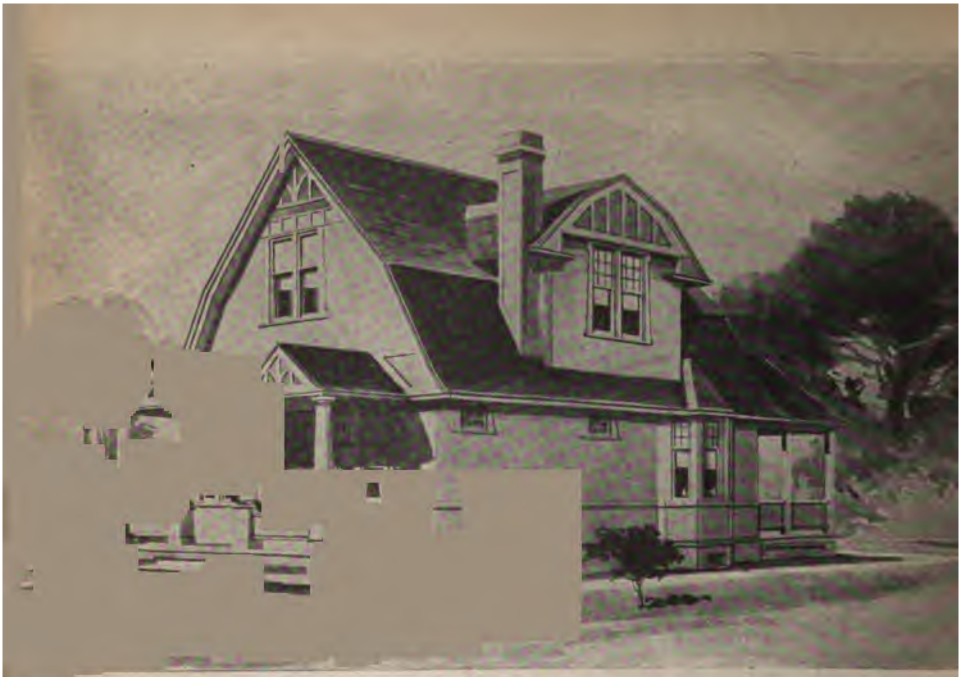
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 28 feet 6 inches; length, 43 feet, exclusive of porch

Blue prints consist of basement plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages *of typewritten matter.*

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,250.00 to about $2,500.00, according to the locality in which it is built.



Design No. 2031

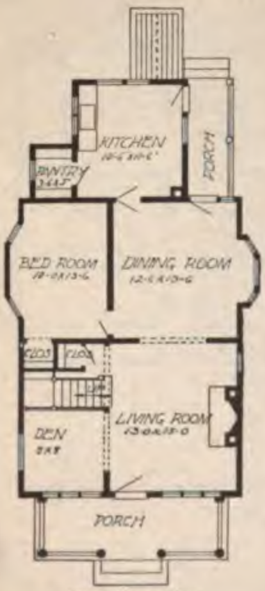
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

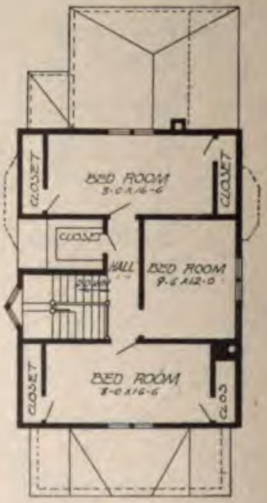
ONLY

$5.00

We mail Plans and Specifications the same day order is received.



First Floor Plan

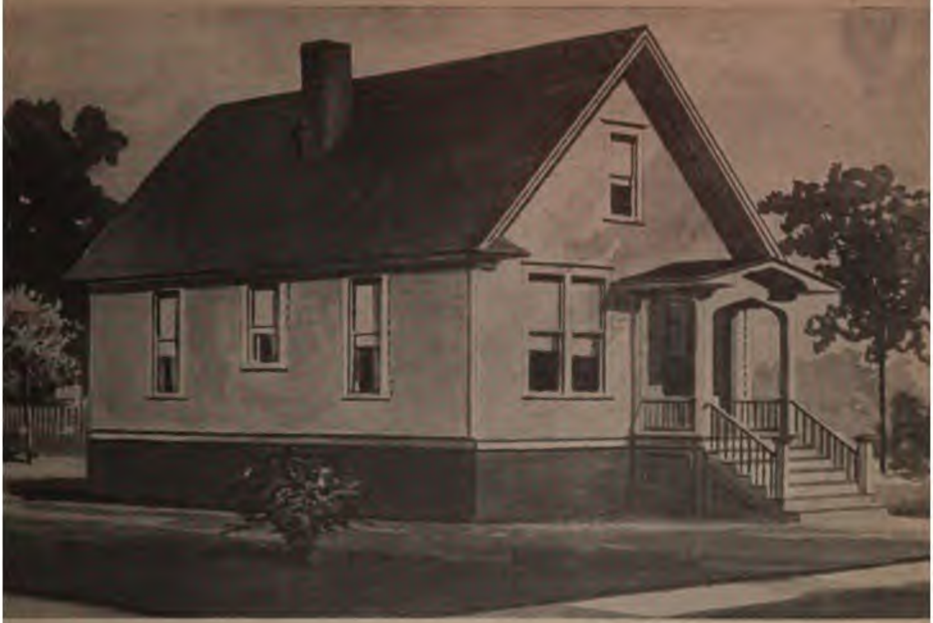


Second Floor Plan

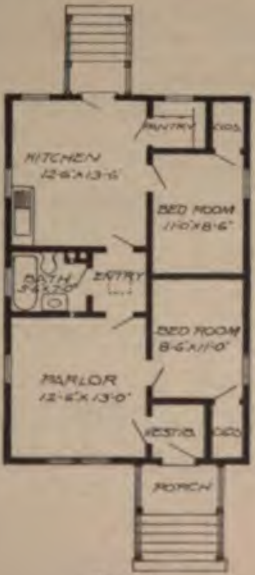
Size: Width, 26 feet 2 inches; length, 42 feet 3 inches, exclusive of porch

Blue prints consist of basement plan; first and second floor plans; front, rear, two side elevations; wall sections and all *necessary interior details. Specifications consist of about twenty pages of typewritten matter.*

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,450.00 to about $2,650.00, according to the locality in which it is built.



Design No. 2004



Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

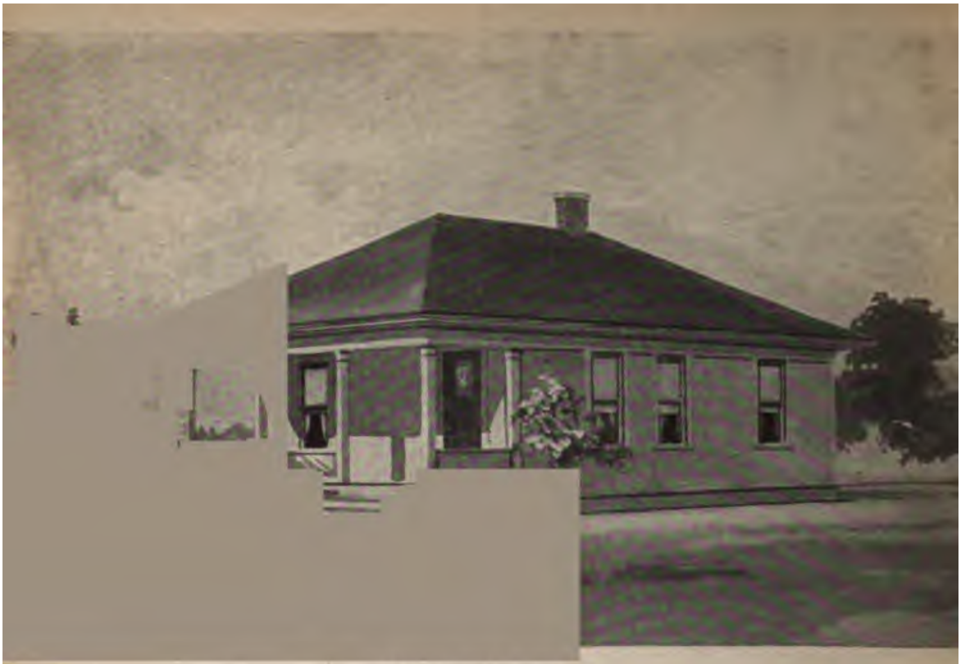
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 22 feet 6 inches; length, 34 feet, exclusive of porch

Blue prints consist of foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $850.00 to about $1,000.00, according to the locality in which it is built.



Design No. 2011

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

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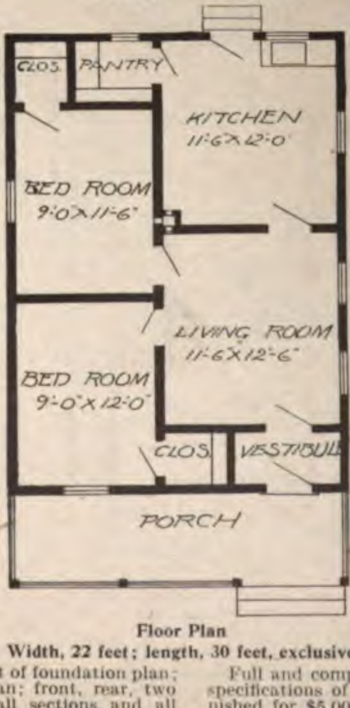
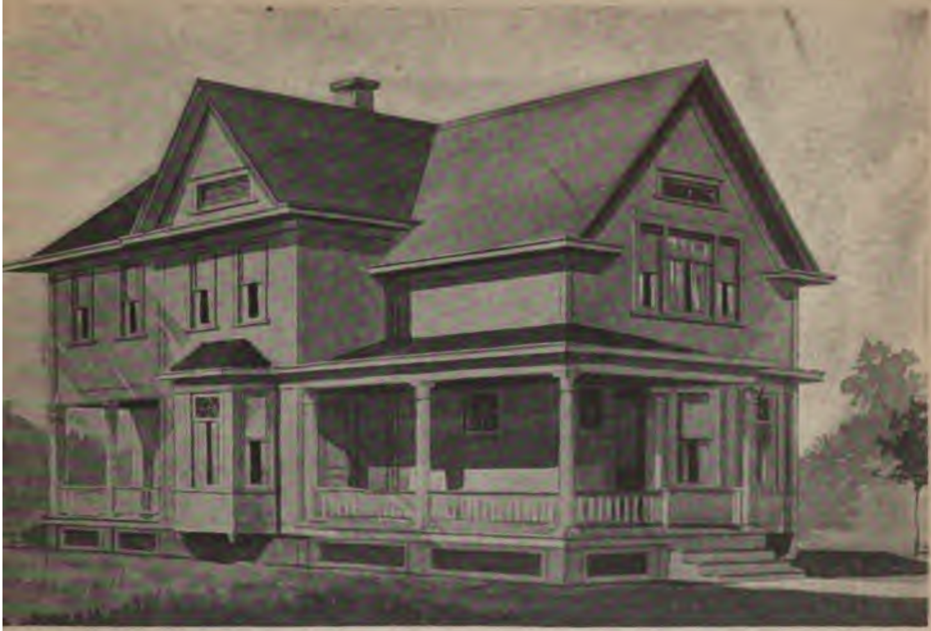


Floor Plan

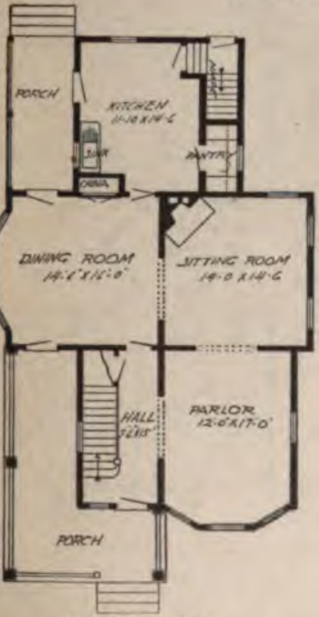
Size: Width, 22 feet; length, 30 feet, exclusive of porch

Blue prints consist of foundation plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

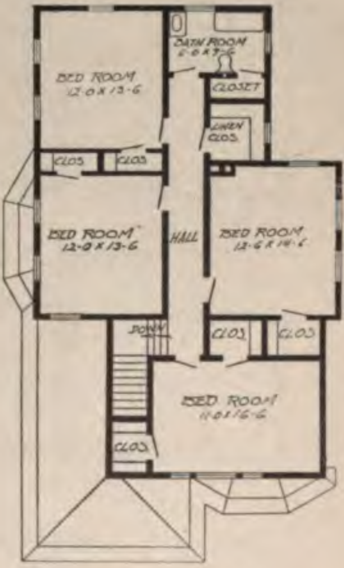
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $750.00 to about $900.00, according to the locality in which it is built.



Design No. 2047



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

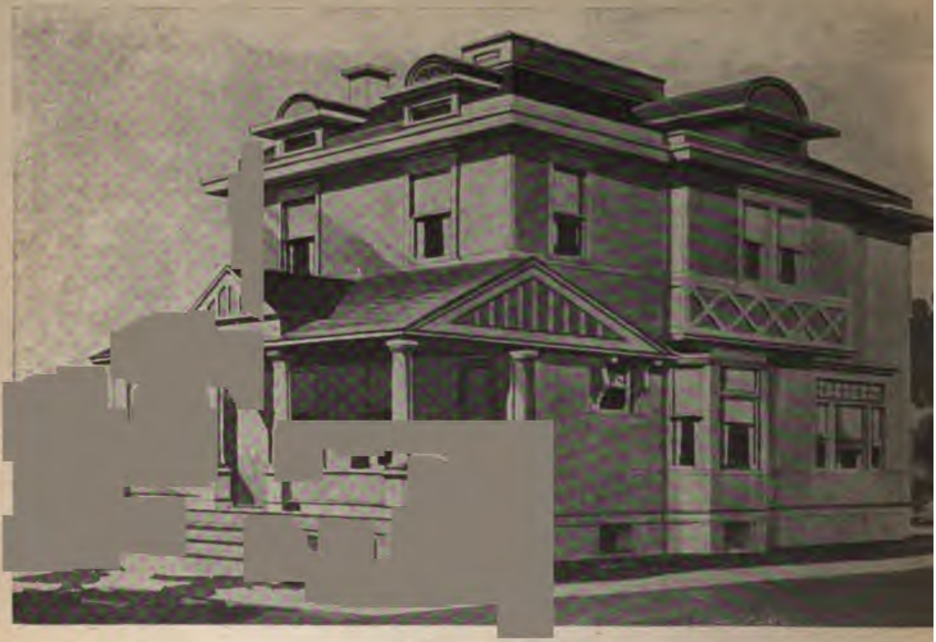
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 30 feet; length, 46 feet, exclusive of porches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages *of typewritten* matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,750.00 to about $3,000.00, according to the locality in which it is built.



Design No. 2030

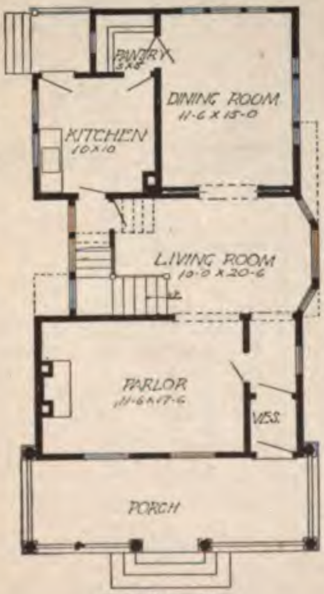
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

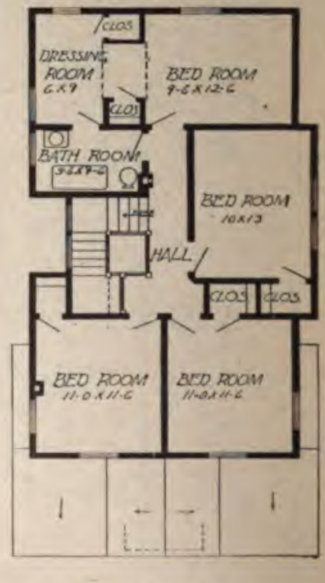
ONLY

$5.00

We mail Plans and Specifications the same day order is received.



First Floor Plan

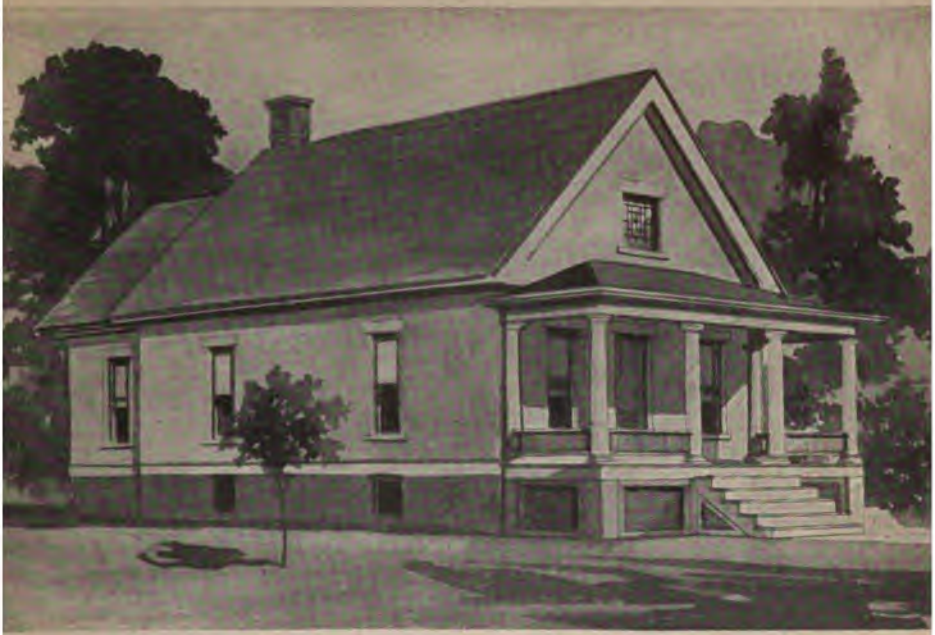


Second Floor Plan

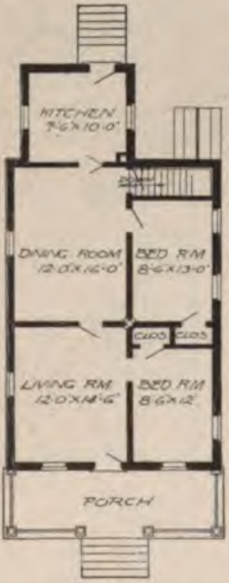
Size: Width, 24 feet 6 inches; length, 39 feet, exclusive of porch

Blue prints consist of basement plan; roof plan; first and second floor plans; *front*, rear, two side elevations wall *sections* and all necessary interior details. *Specifications* consist of about twenty *pages* of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,950.00 to about $2,100.00, according to the locality in which it is built.



Design No. 2010



Floor Plan

PRICE

of Blue
Prints, together with
a complete
set of typewritten
specifications is

ONLY

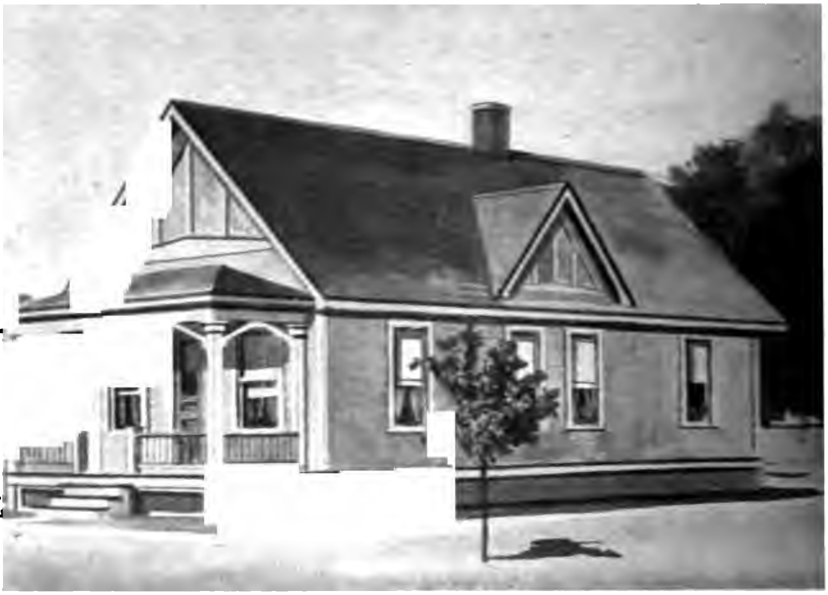
$5.00

We mail
Plans and
Specifications the
same day
order is received.

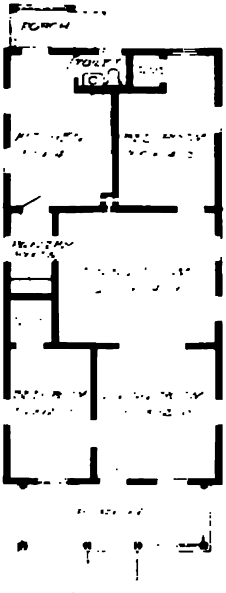
Size: Width 22 feet 8 inches: length, 42 feet 8 inches, exclusive of porch

Blue prints consist of basement plan; roof plan; floor plan; front, rear, two sides elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $850.00 to about $1,000.00, according to the locality in which it is built.



Design No. 2001



PRICE

of Blue Print together with a complete set of typewritten specification is

ONLY

$5.00

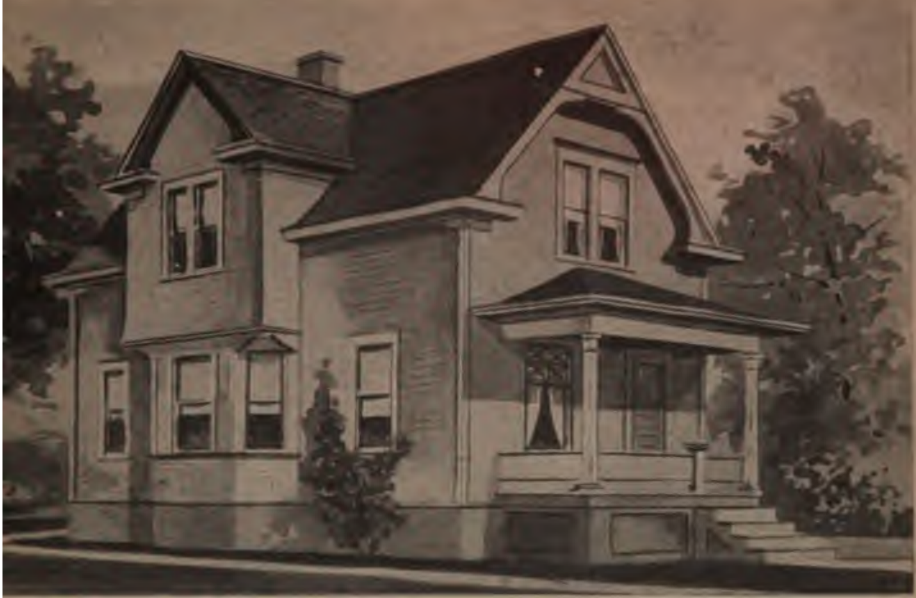
We mail Plan and specification the same day order is received.

Floor Plan

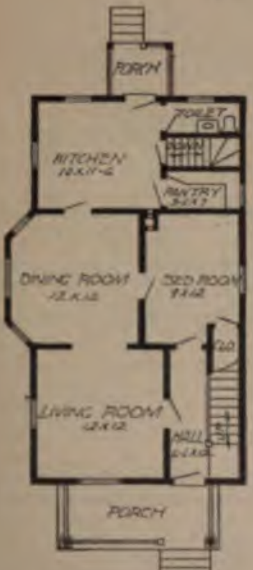
Size: Width, 20 feet; length, 40 feet, exclusive of porches

Blue prints consist of foundation plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifica-
consist of about fifteen pages of
ten matter.

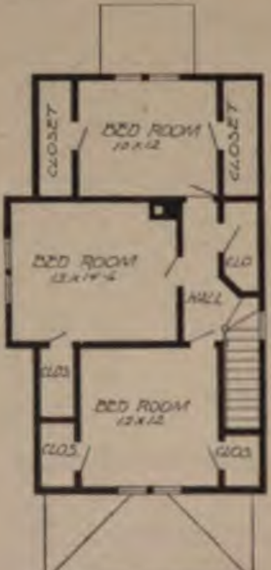
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,150.00 to about $1,300.00, according to the locality in which it is built.



Design No. 2032



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

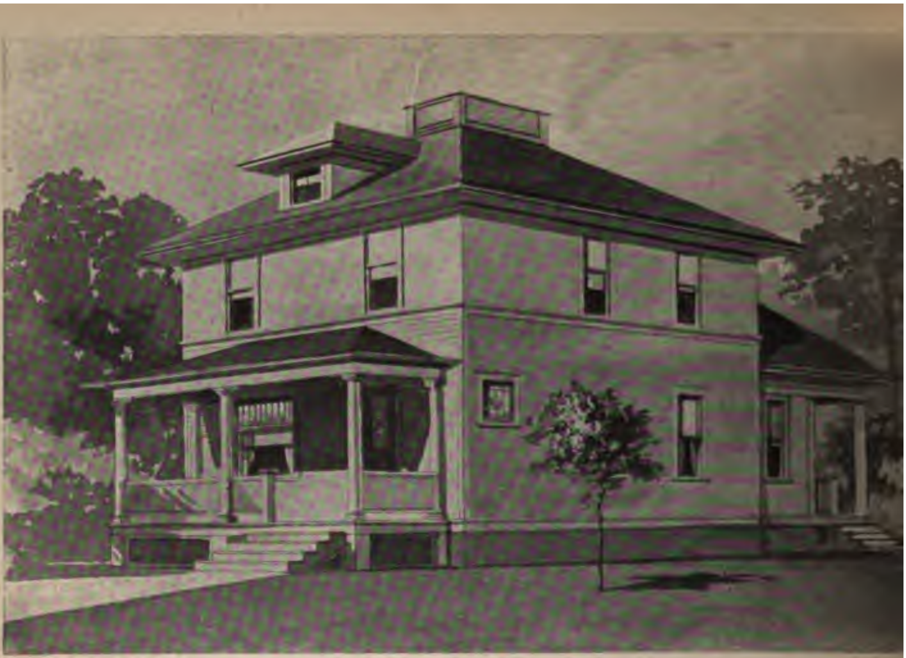
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 22 feet 6 inches; length, 36 feet, exclusive of porches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,650.00 to about $1,800.00, according to the locality in which it is built.



Design No. 2013

PRICE
of Blue Prints, together with a complete set of typewritten specifications is
ONLY
$5.00

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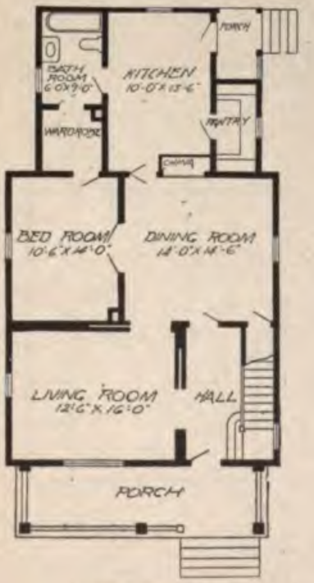
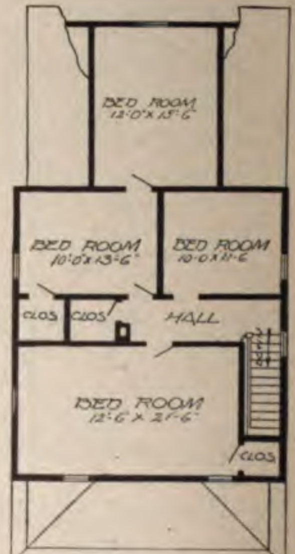


First Floor Plan

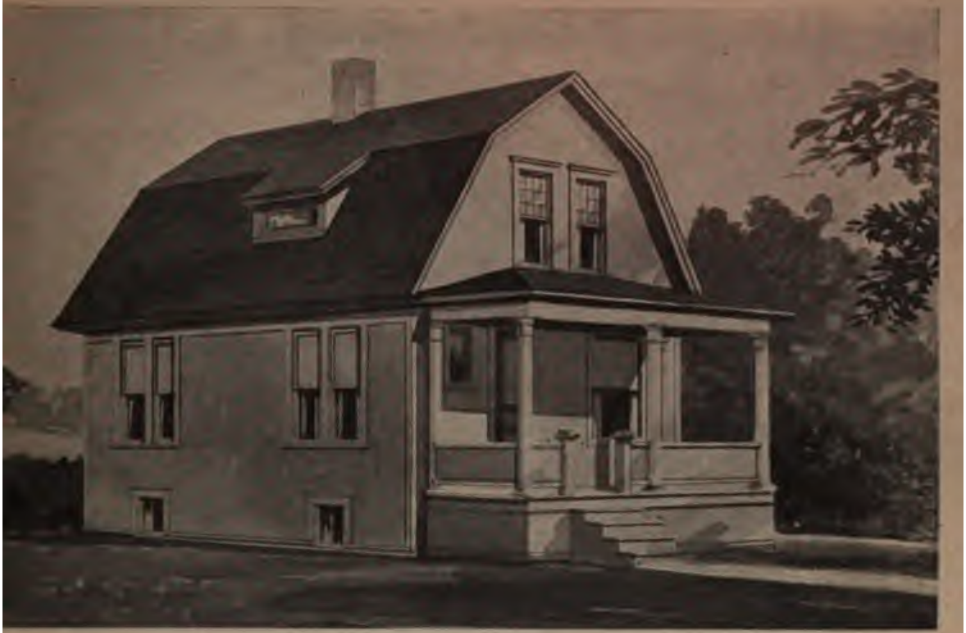


Second Floor Plan

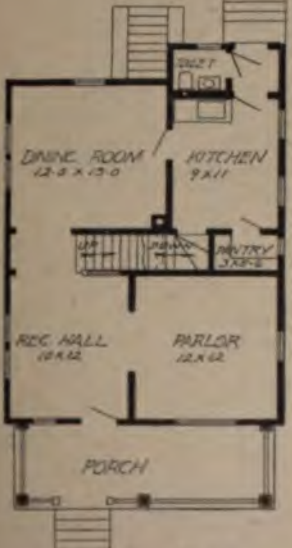
Size: Width, 26 feet; length, 44 feet 6 inches, exclusive of porch

Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

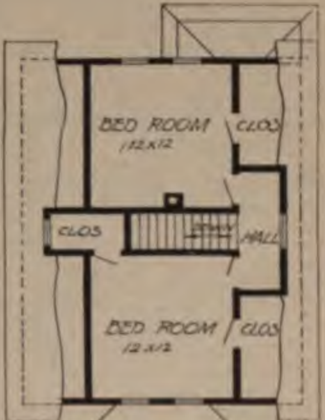
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,050.00 to about $2,300.00, according to the locality in which it is built.



Design No. 2041



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

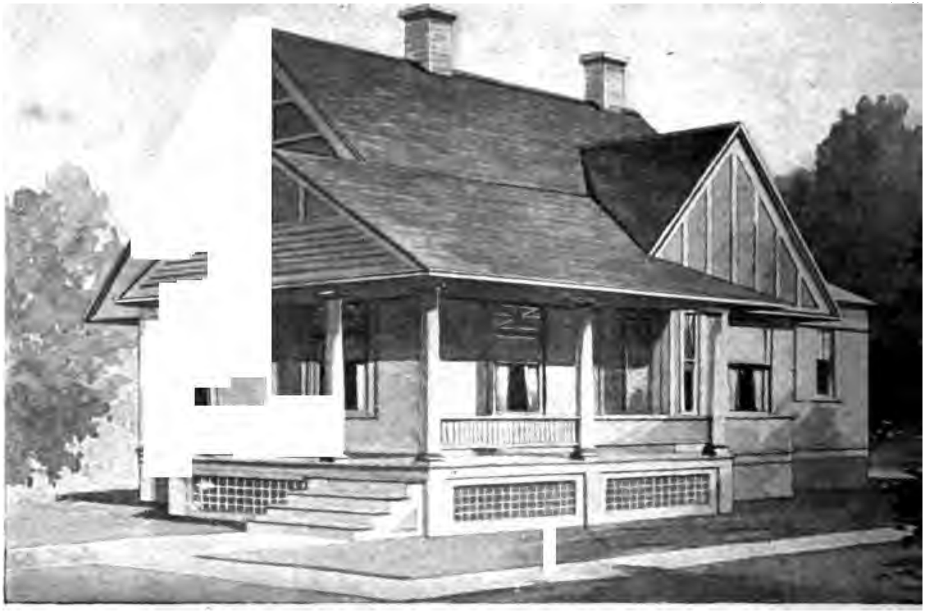
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 23 feet 6 inches; length, 32 feet exclusive of porch

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,050.00 to about $1,200.00, according to the locality in which it is built.



Design No. 2028

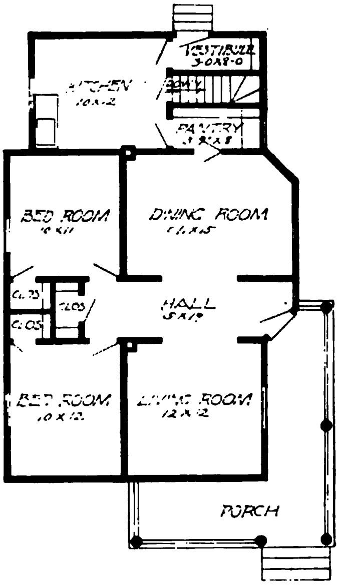
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

We mail Plans and Specifications the same day order is received.

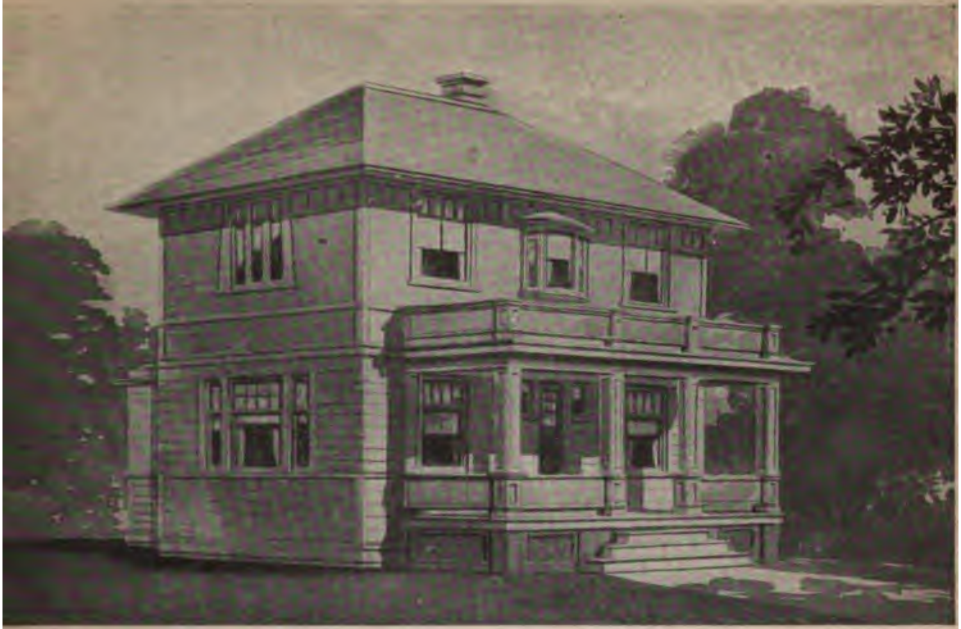


Floor Plan

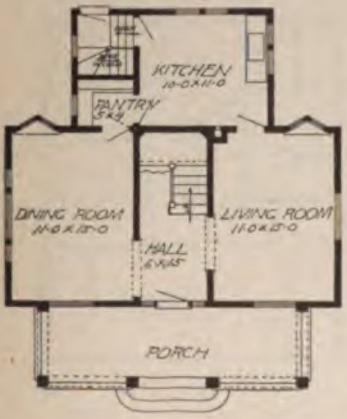
Size: Width, 26 feet 6 inches; length, 40 feet 6 inches exclusive of porches

Blue prints consist of basement plan; roof plan; floor plan; front, rear, two side ations; wall sections and all neces- interior details. Specifications con- of about fifteen pages of typewritten ter.

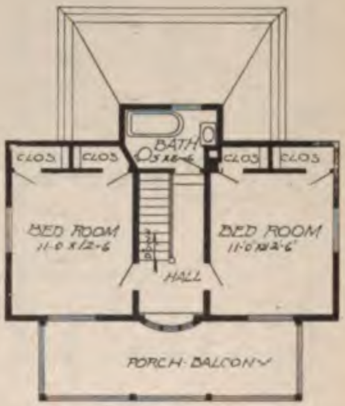
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,550.00 to about $1,750.00, according to the locality in which it is built.



Design No. 2044



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

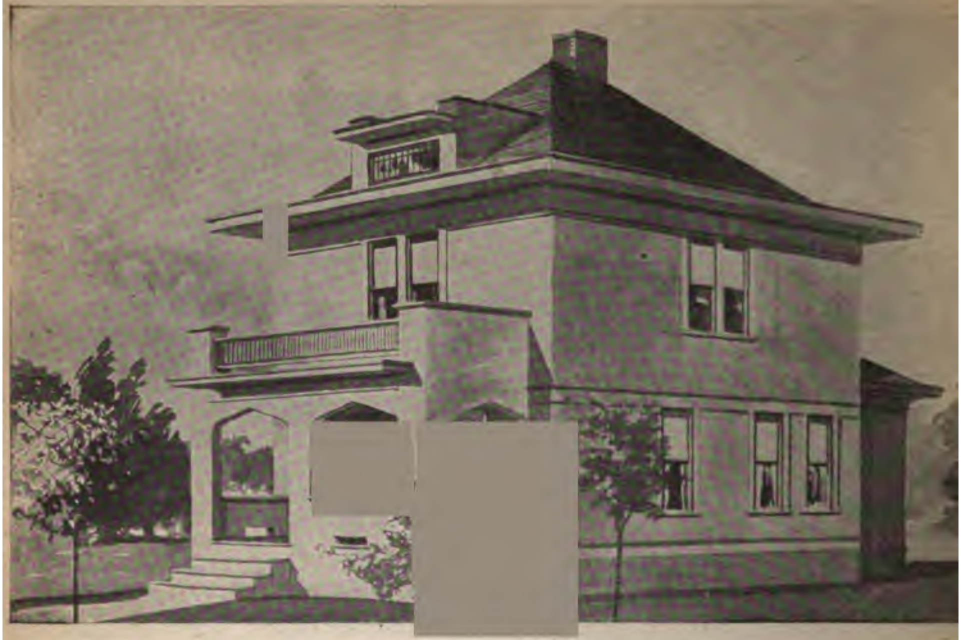
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 30 feet; length, 26 feet 6 inches, exclusive of porch

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear and two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,650.00 to about $1,850.00, according to the locality in which it is built.



Design No. 2021

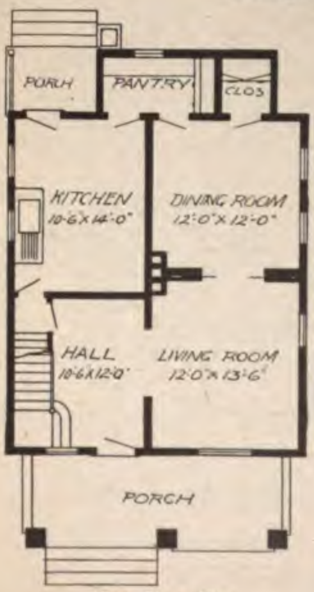
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

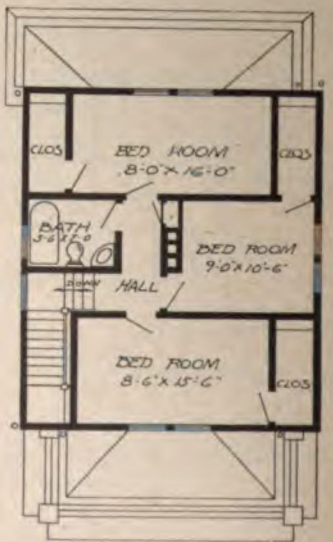
ONLY

$5.00

We mail Plans and Specifications the same day order is received.



First Floor Plan

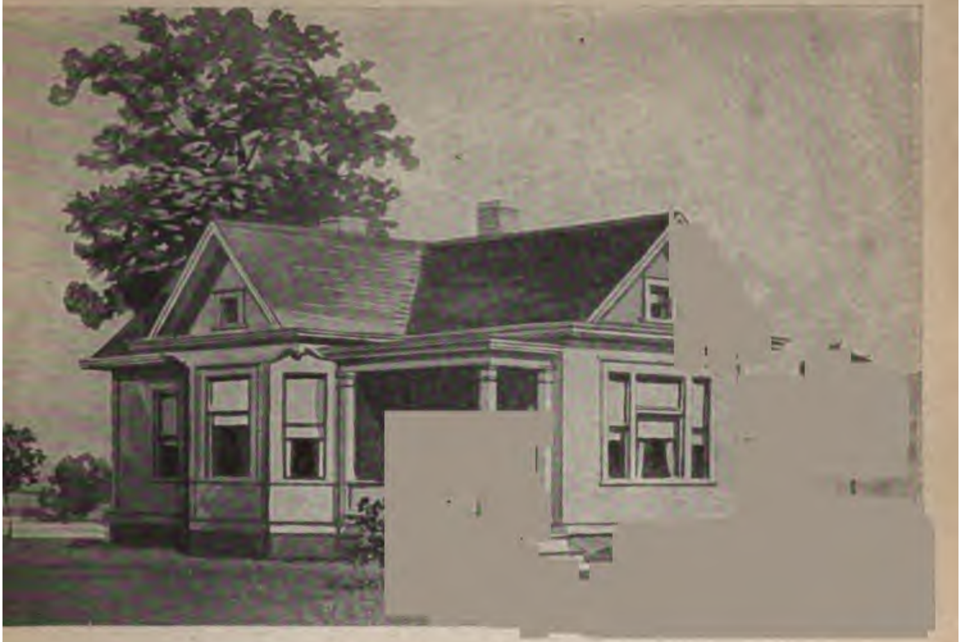


Second Floor Plan

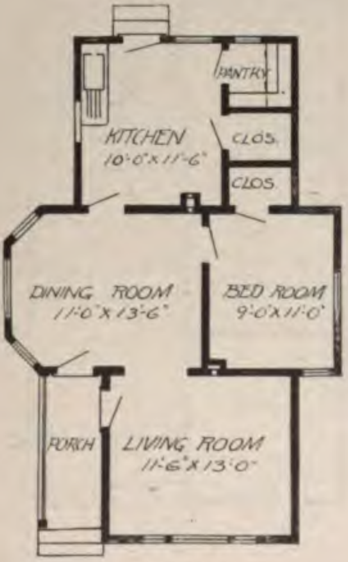
Size: Width, 24 feet; length, 32 feet, 6 inches, exclusive of porch

Blue prints consist of basement plan; first and second floor plans: front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,950.00 to about $2,200.00, according to the locality in which it is built.



Design No. 2020



Floor Plan

Size: Width, 24 feet; length, 36 feet

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

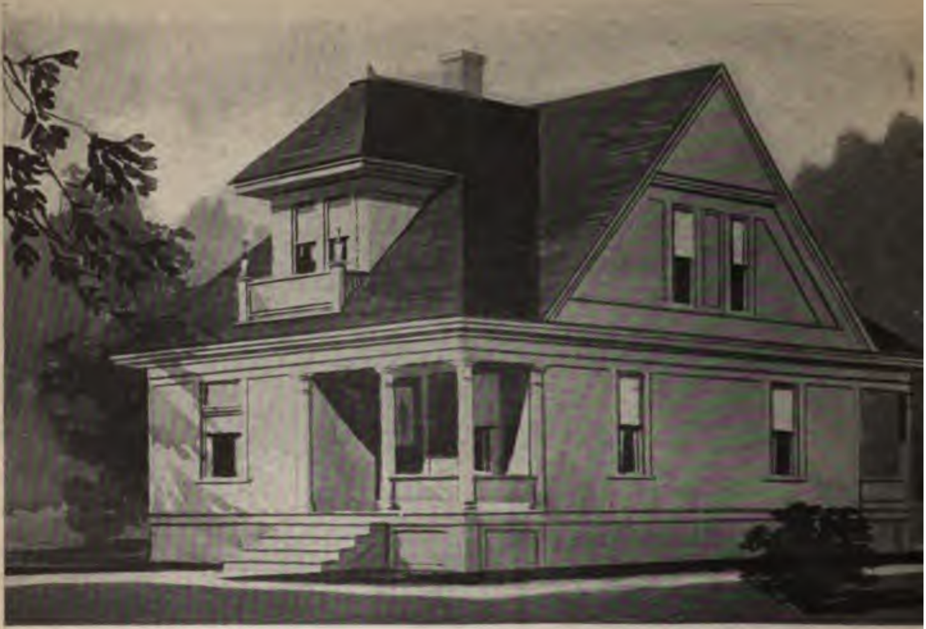
ONLY

$5.00

We mail Plans and Specifications the same day order is received.

Blue prints consist of foundation plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior deatils. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $950.00 to about $1,100.00, according to the locality in which it is built.



Design No. 2038

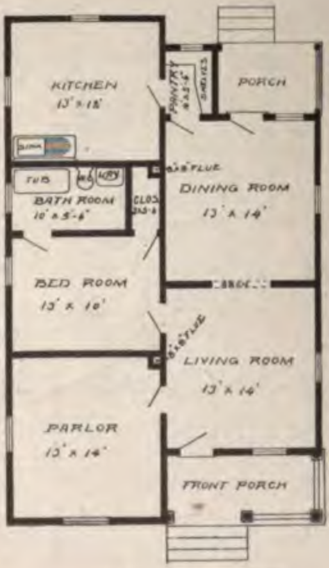
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

We mail Plans and Specifications the same day order is received.

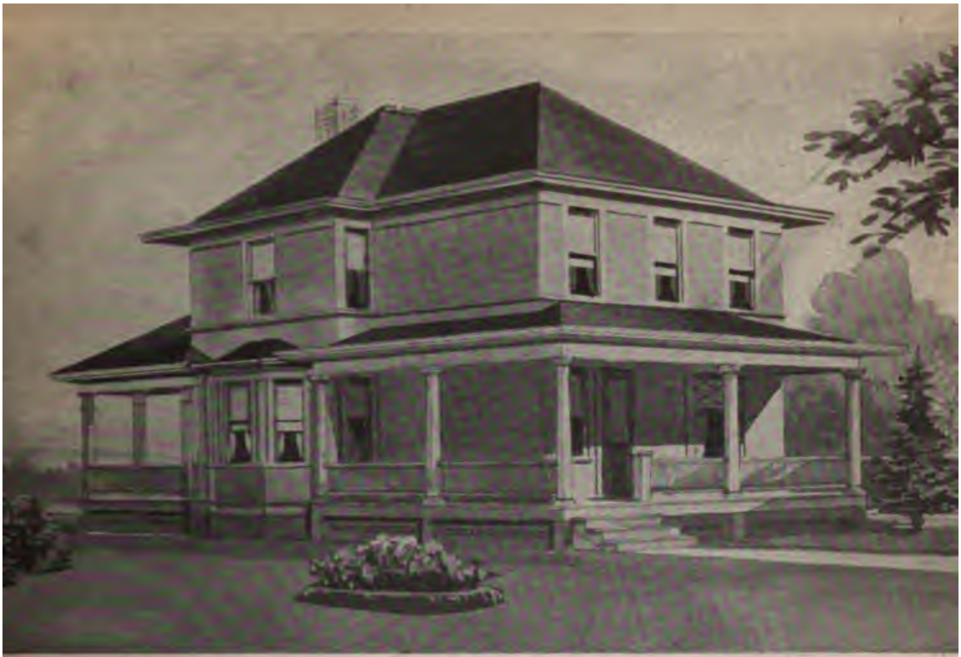


Floor Plan

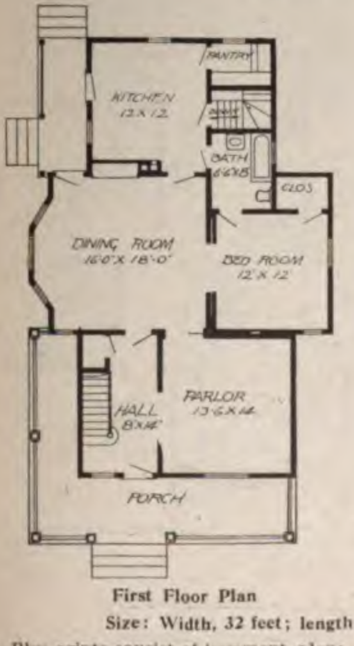
Size: Width, 27 feet, 6 inches; length, 44 feet

Blue prints consist of basement plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

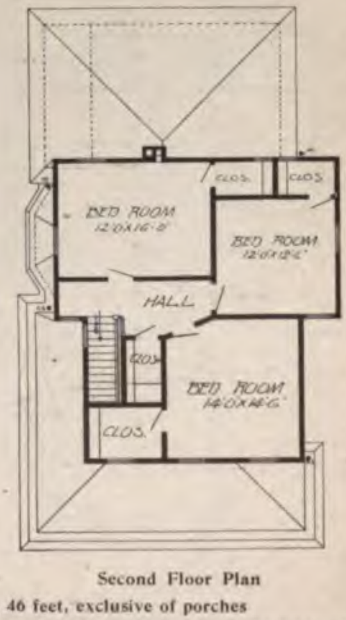
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,750.00 to about $1,900.00, according to the locality in which it is built.



Design No. 2023



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

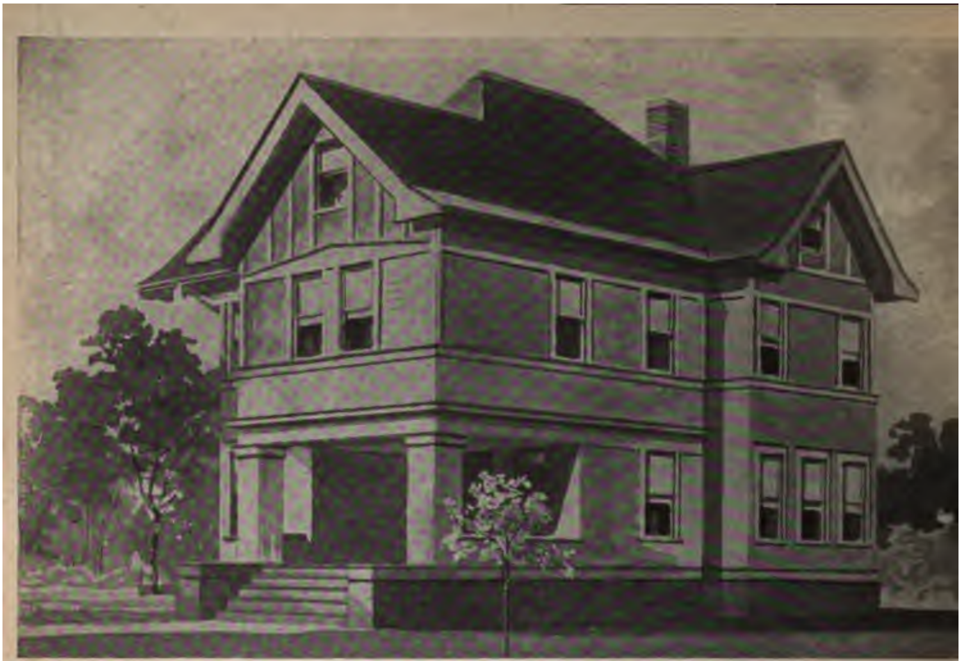
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 32 feet; length, 46 feet, exclusive of porches

Blue prints consist of basement plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,350.00 to about $2,600.00, according to the locality in which it is built.



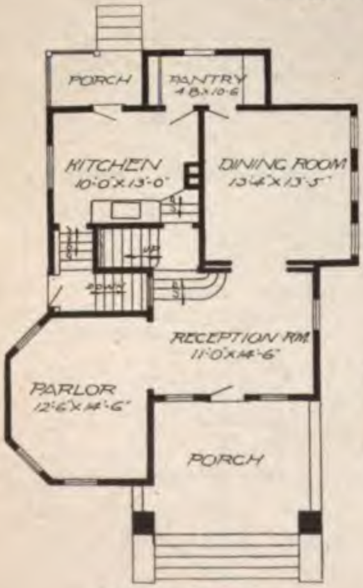
Design No. 2012

PRICE
of Blue Prints, together with a complete set of typewritten specifications is

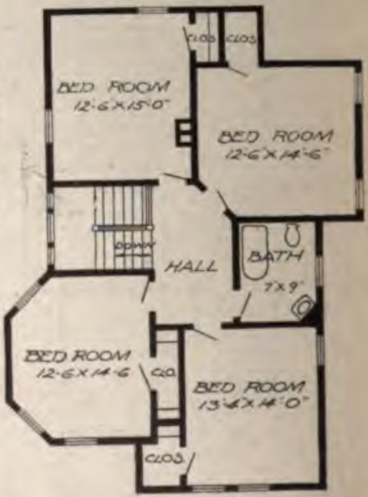
ONLY

$5.00

We mail Plans and Specifications the same day order is received.



First Floor Plan

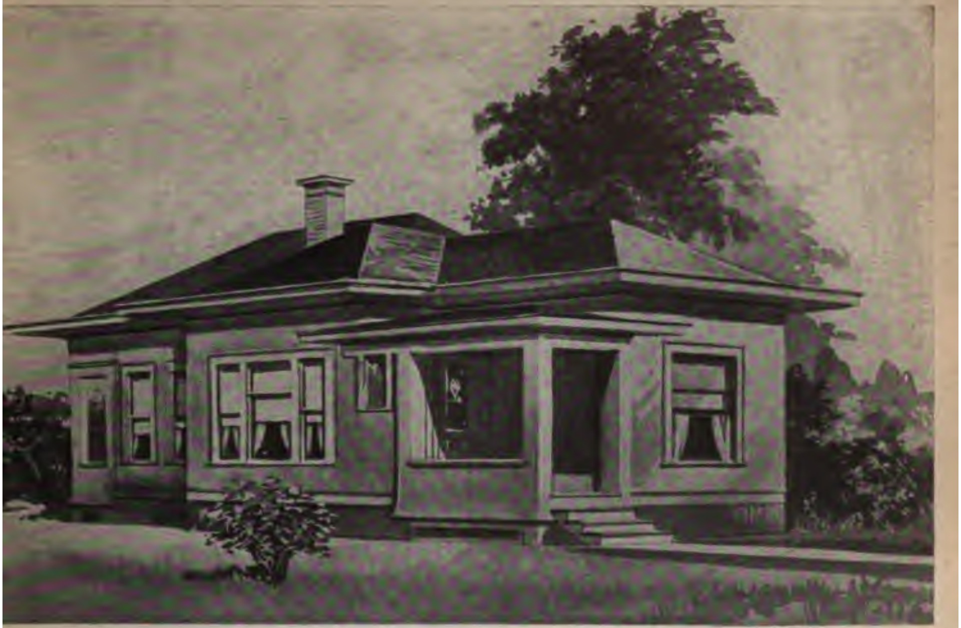


Second Floor Plan

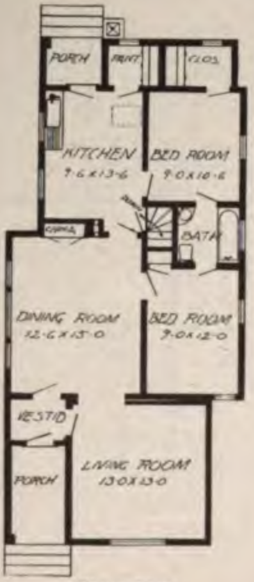
Size: Width, 32 feet; length, 39 feet, exclusive of porch

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,750.00 to about $3,000.00, according to the locality in which it is built.



Design No. 2018



Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

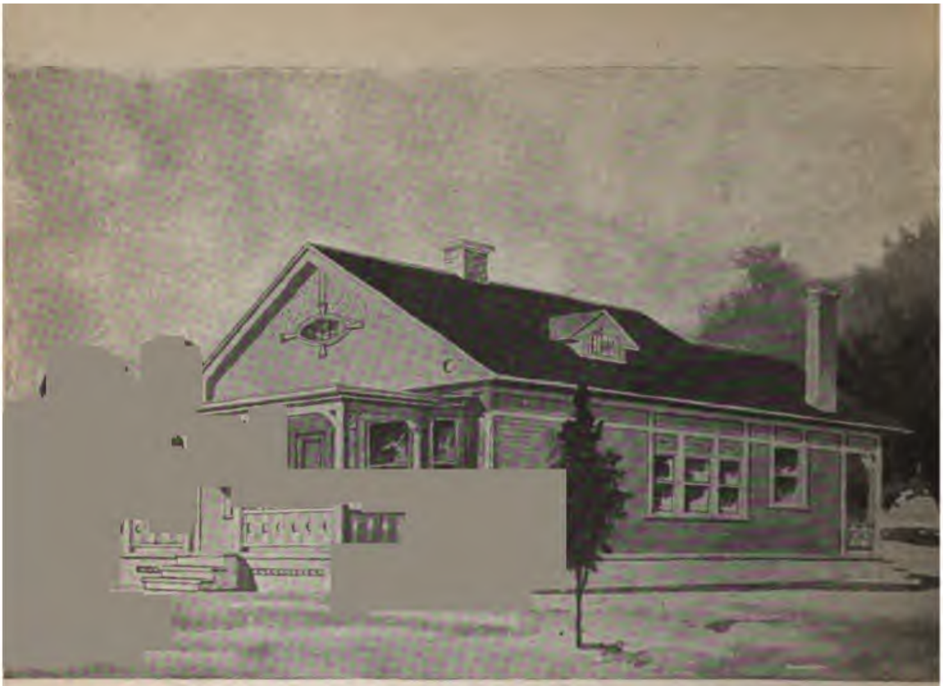
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 25 feet; length, 48 feet 6 inches

Blue prints consist of foundation plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,250.00 to about $1,500.00, according to the locality in which it is built.



Design No. 2027

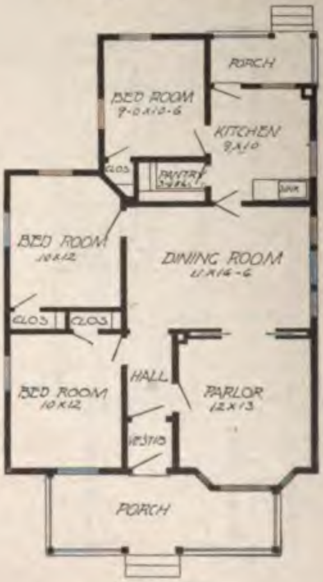
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

We mail Plans and Specifications the same day order is received.

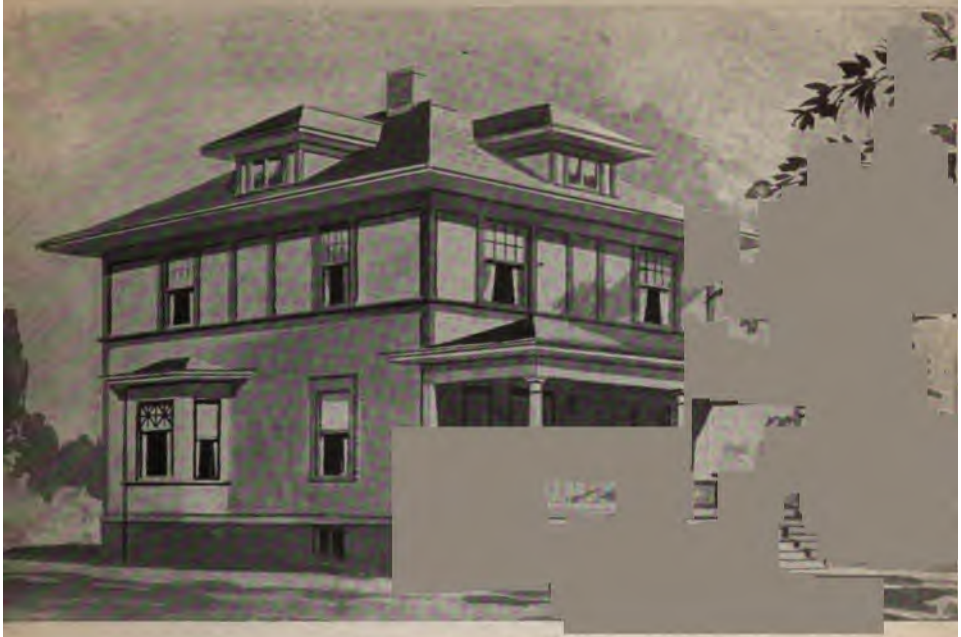


Floor Plan

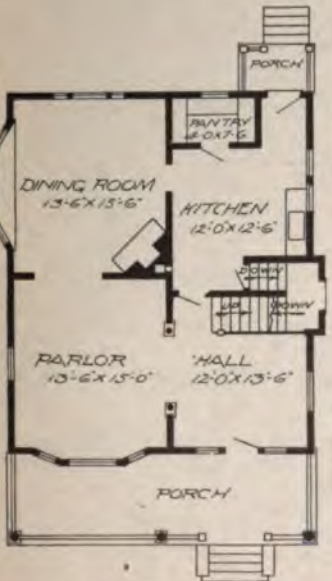
Size: Width, 28 feet; length, 41 feet, exclusive of porch

Blue prints consist of basement plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

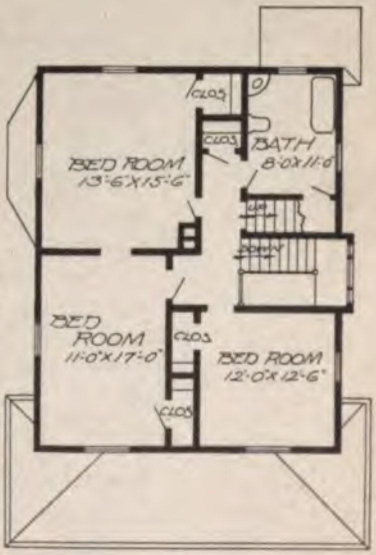
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,150.00 to about $1,300.00, according to the locality in which it is built.



Design No. 2007



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

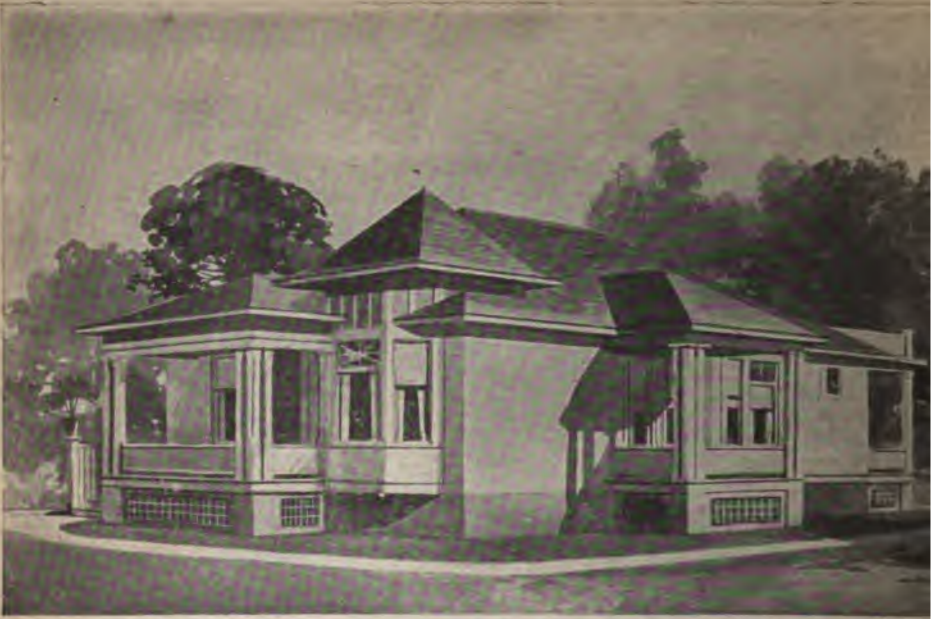
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 29 feet 6 inches; length, 33 feet, exclusive of porches

Blue prints consist of basement plan; first and second floor plans; front, rear, two side elevations;wall sections and all necessary interior details Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2.300.00 to about $2.550.00, according to the locality in which it is built.



Design No. 2029

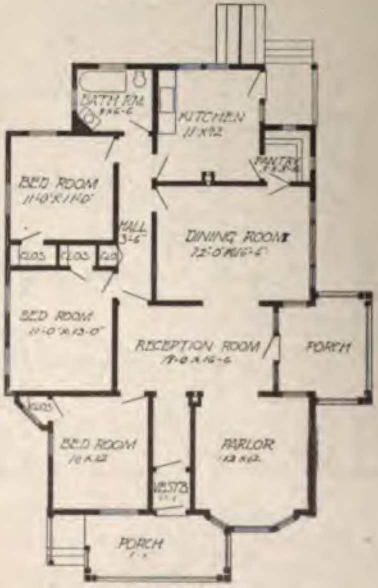
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

We mail Plans and Specifications the same day order is received.

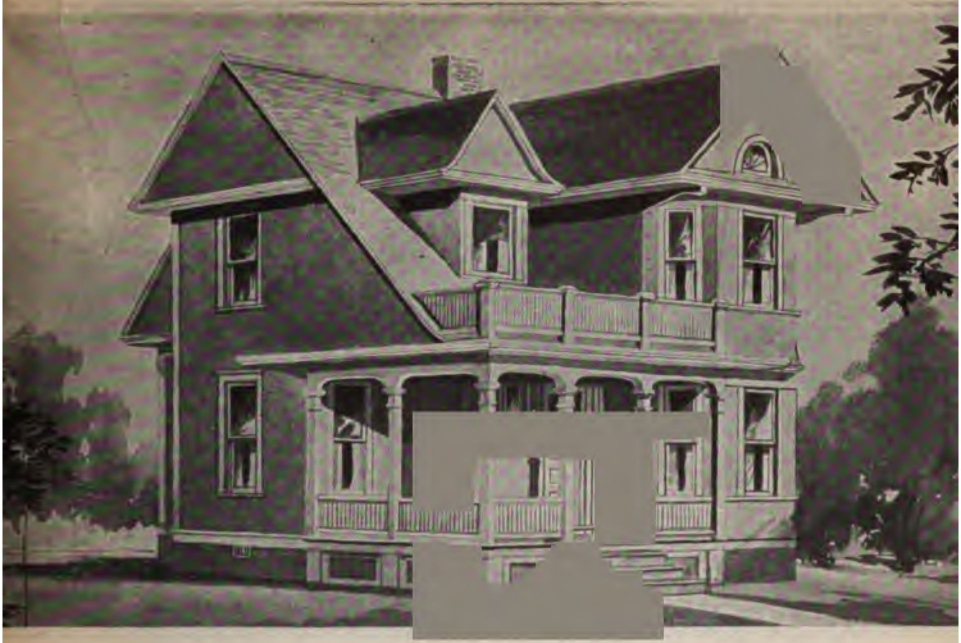


Floor Plan

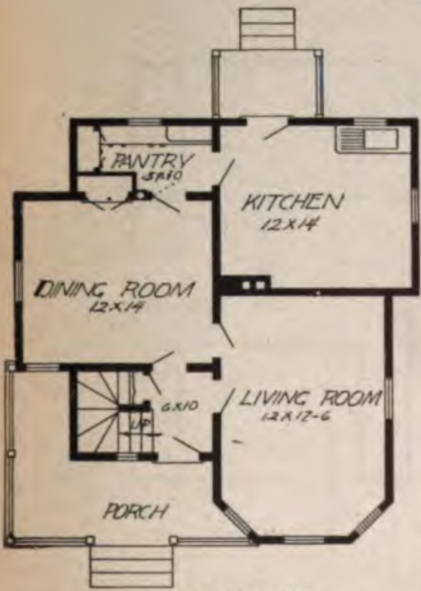
Size: Width, 32 feet 6 inches; length, 47 feet 6 inches, exclusive of porch

Blue prints consist of basement plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications *consist of* about fifteen pages of type*written matter.*

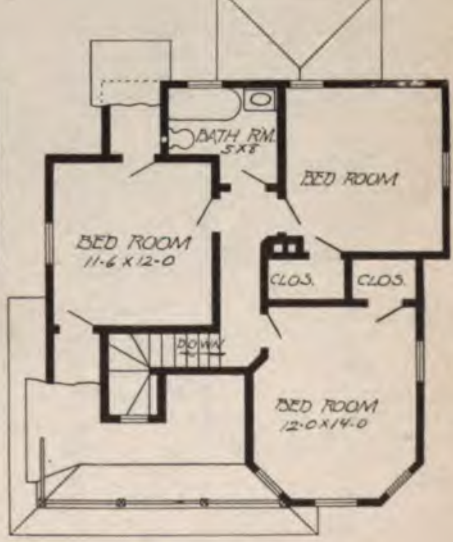
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,650.00 to about $1,850.00, according to the locality in which it is built.



Design No. 2040



First Floor Plan



Second Floor Plan

Size: Width, 29 feet 6 inches; length, 31 feet, exclusive of porches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,750.00 to about $1,900.00, according to the locality in which it is built.

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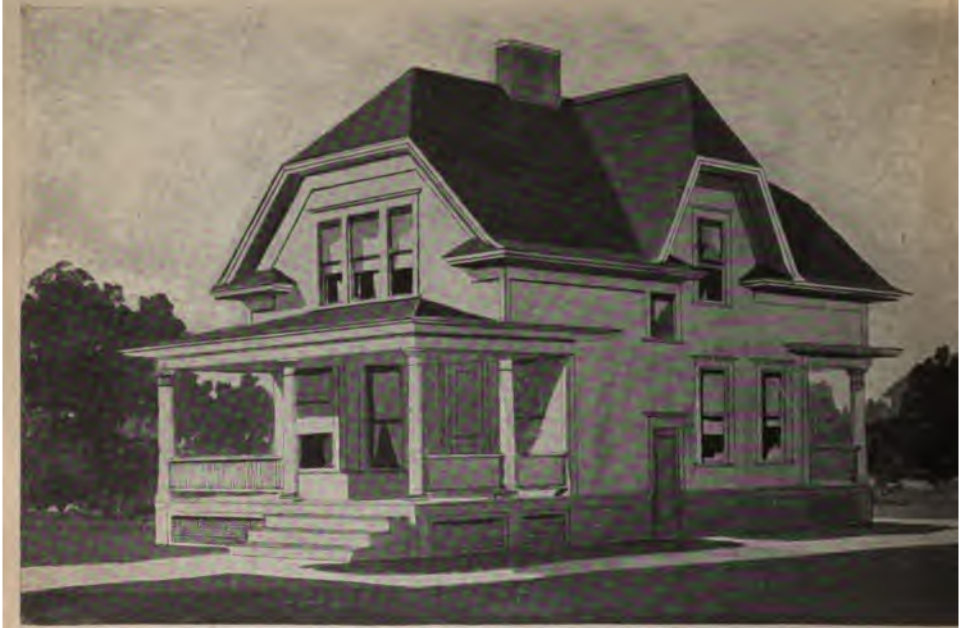


Design No. 2017

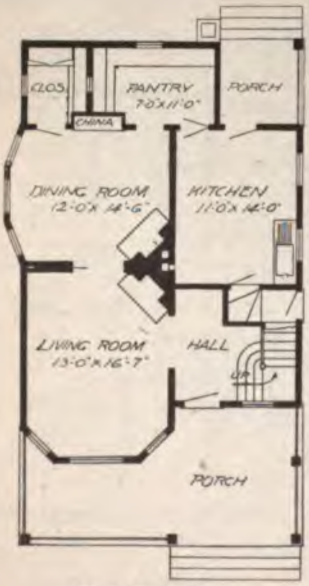
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

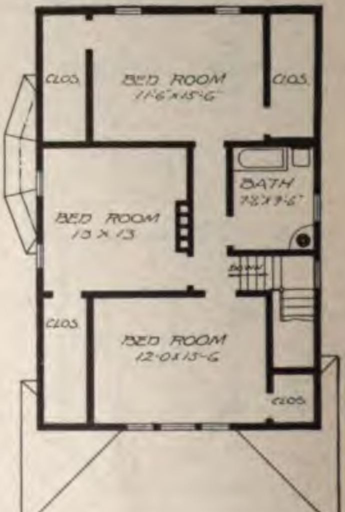
ONLY

$5.00

We mail Plans and Specifications the same day order is received.



First Floor Plan

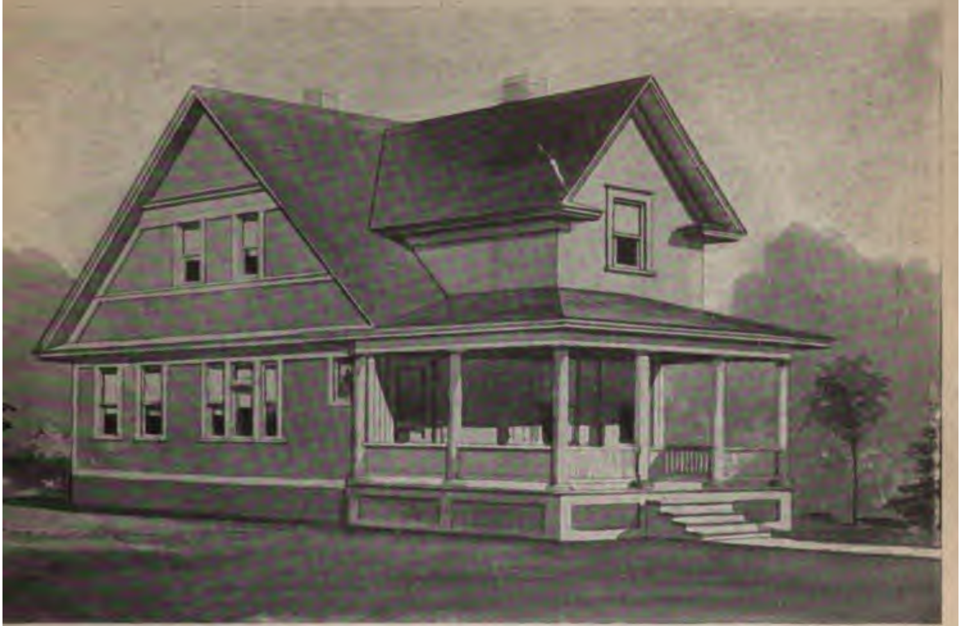


Second Floor Plan

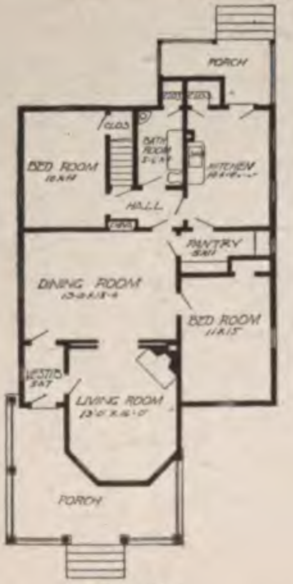
Size: Width, 27 feet; length, 38 feet, exclusive of porch

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,850.00 to about $2,250.00, according to the locality in which it is built.



Design No. 2042



Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

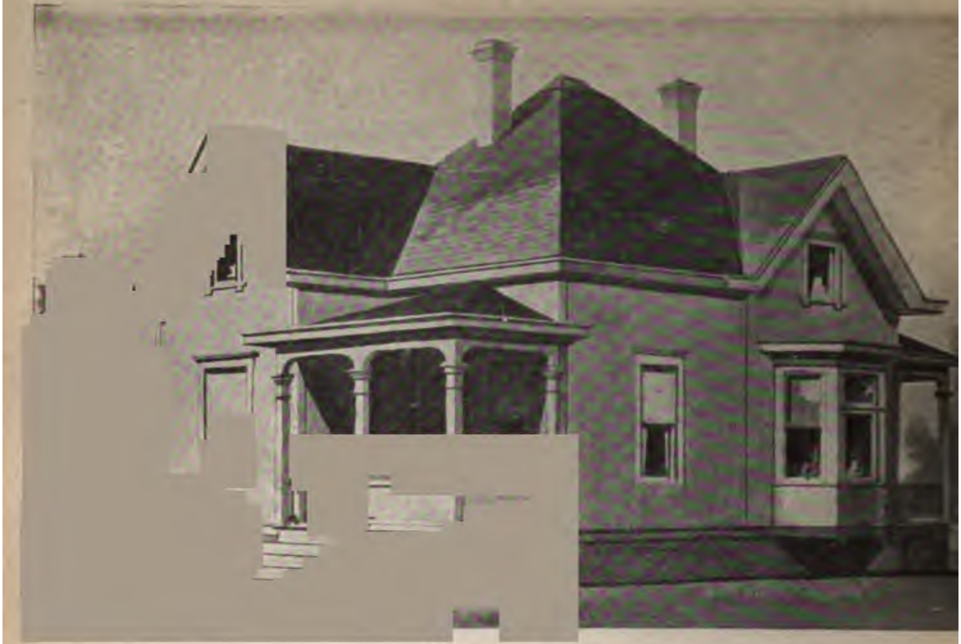
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 31 feet; length, 45 feet 6 inches, exclusive of porches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,750.00 to about $1,900.00, according to the locality in which it is built.



Design No. 2048

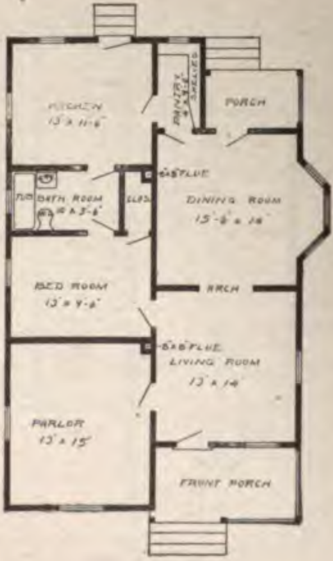
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

$5.00

We mail Plans and Specifications the same day order is received.

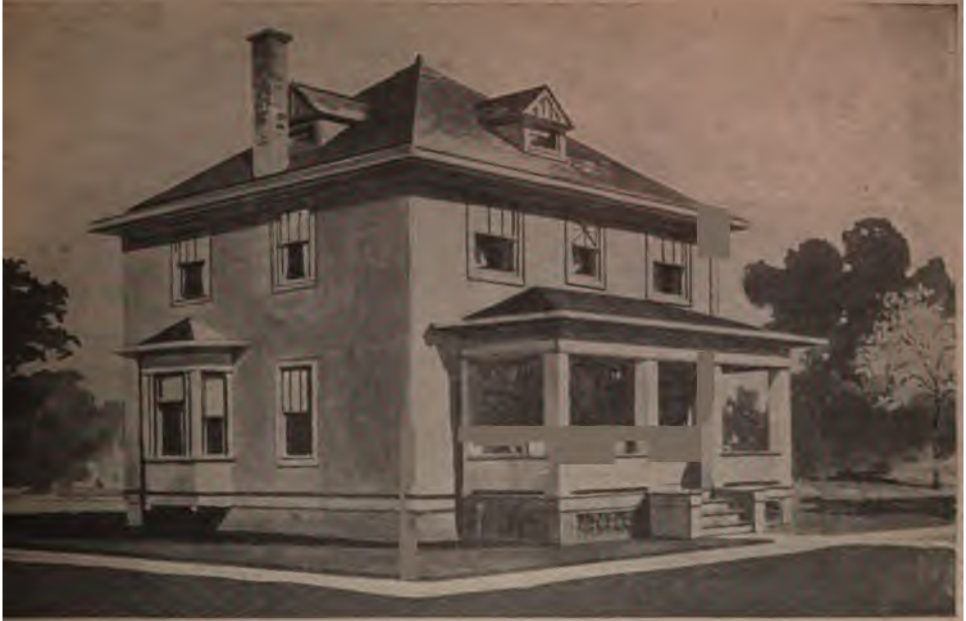


Floor Plan

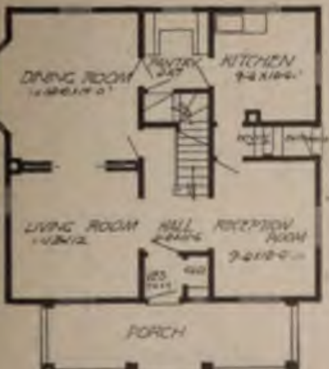
Size: Width, 27 feet 6 inches; length, 44 feet, exclusive of porch

Blue prints consist of basement plan: roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

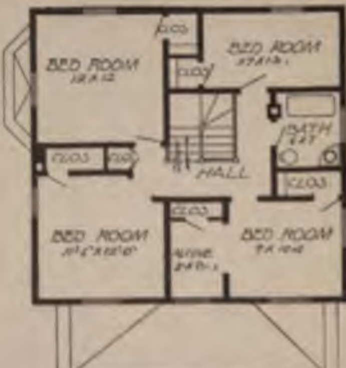
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,450.00 to about $1,600.00, according to the locality in which it is built.



Design No. 2026



First Floor Plan



Second Floor Plan

PRICE
of Blue Prints, together with a complete set of typewritten specifications is

ONLY

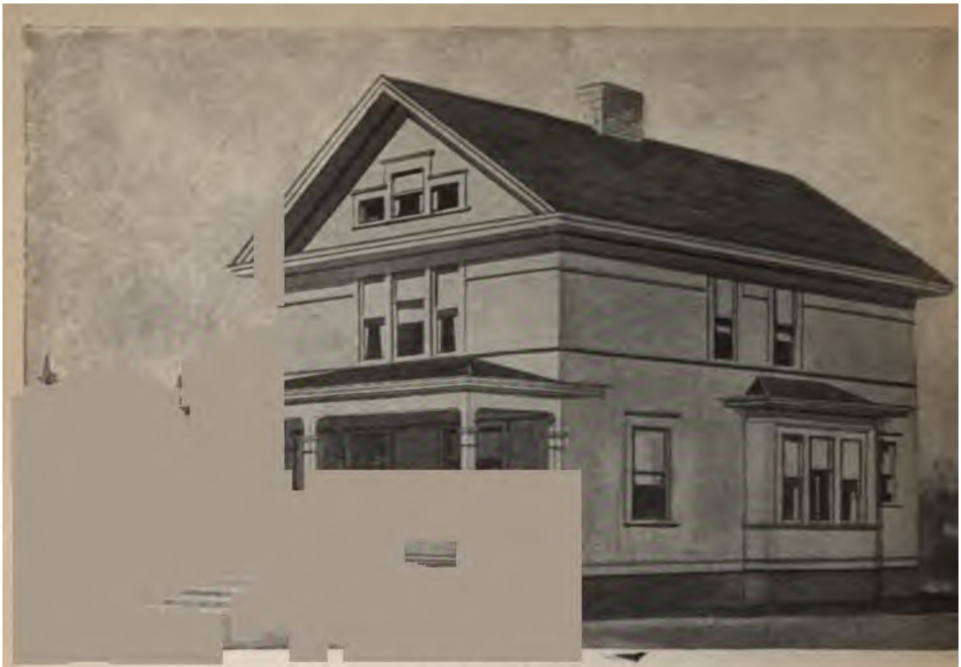
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 29 feet 6 inches; length, 28 feet exclusive of porch

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be fur- [illegible] t of this house is [illegible] out $1,850.00, [illegible] h it is [illegible]



Design No. 2024

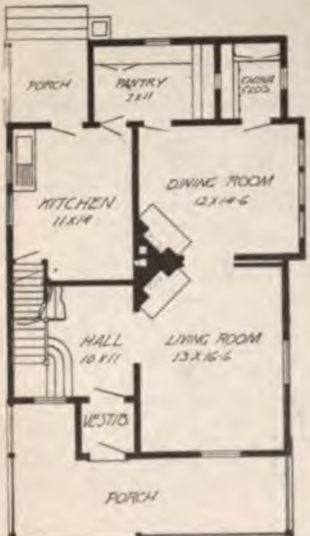
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

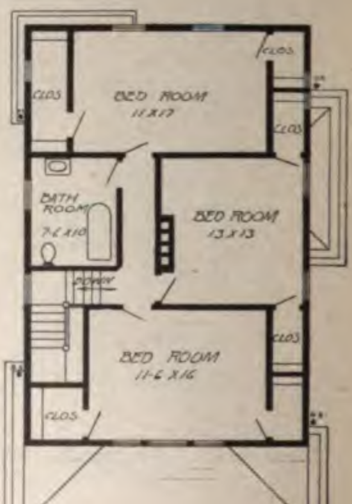
ONLY

$5.00

We mail Plans and Specifications the same day order is received.



First Floor Plan

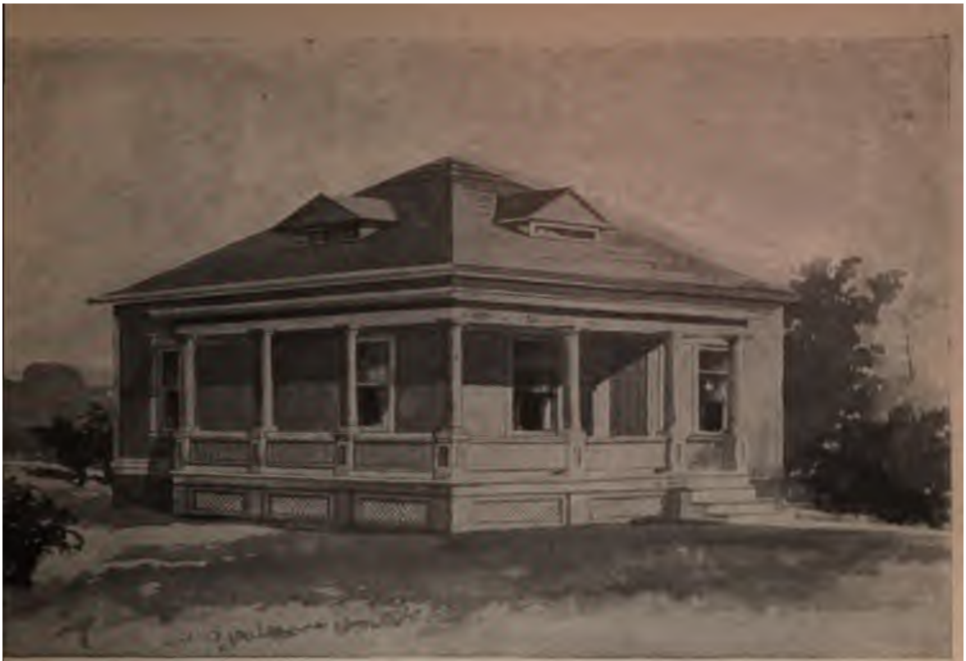


Second Floor Plan

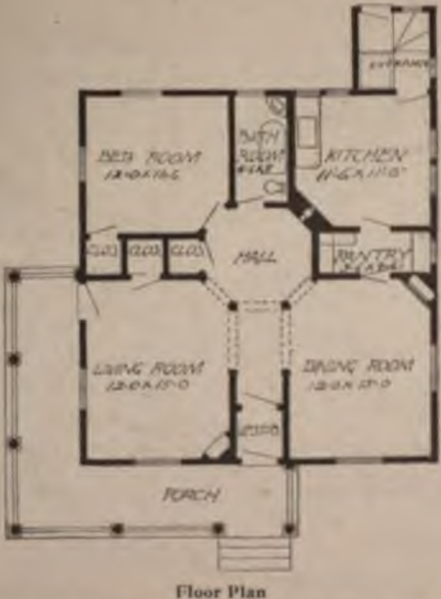
Size: Width, 26 feet 9 inches; length, 44 feet 6 inches, exclusive of porch

Blue prints consist of basement plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,850.00 to about $2,100.00, according to the locality in which it is built.



Design No. 2043



Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

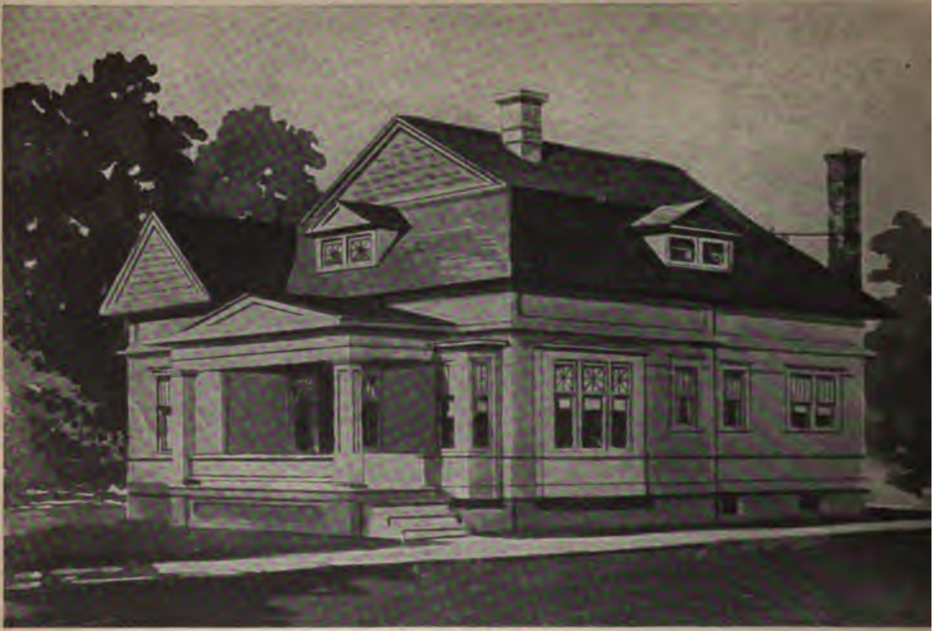
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 30 feet; length, 38 feet 6 inches, exclusive of porches

Blue prints consist of basement plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages [illegible] matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $950.00 to about $1,100.00, according to the locality in which it is



Design No. 2045

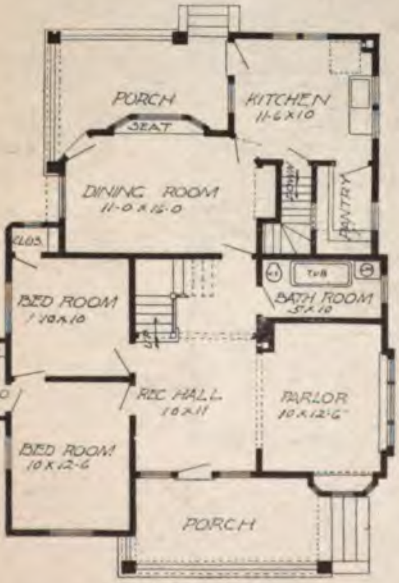
PRICE

of Blue Prints, together with a complete set of typewritten specifications is

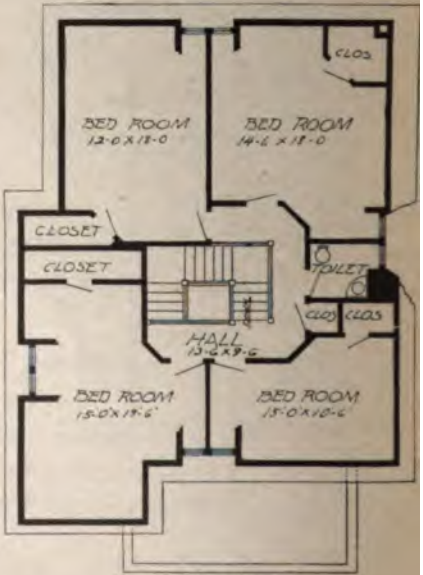
ONLY

$5.00

We mail Plans and Specifications the same day order is received.



First Floor Plan

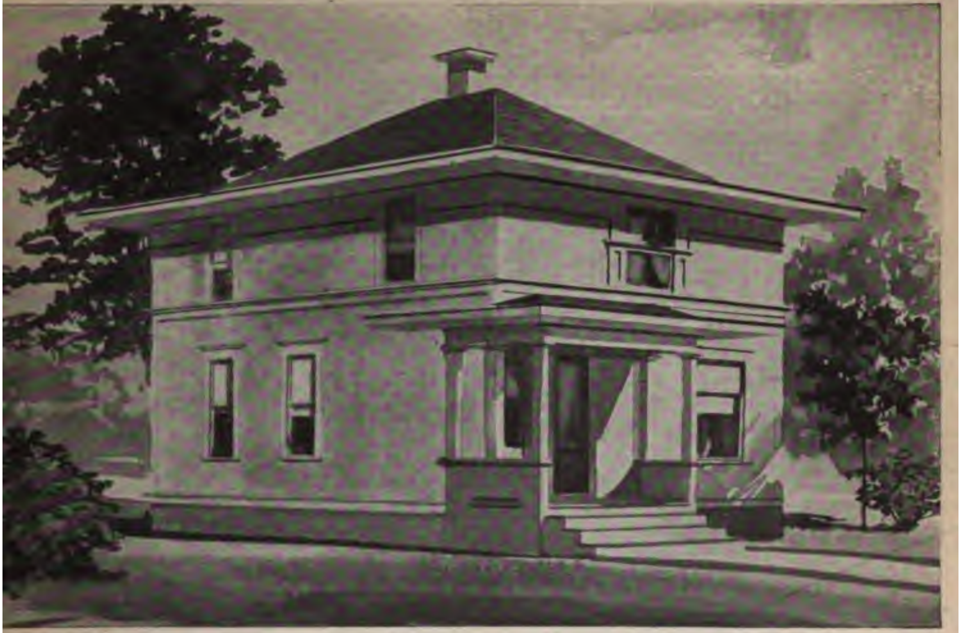


Second Floor Plan

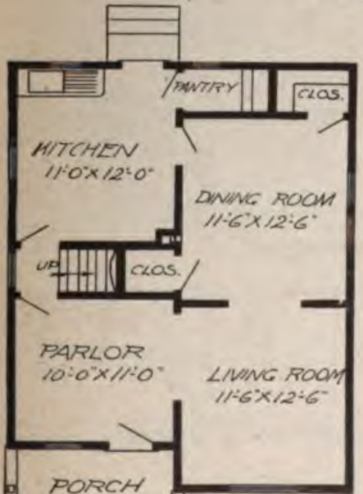
Size: Width, 32 feet; length, 42 feet 6 inches, exclusive of porches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

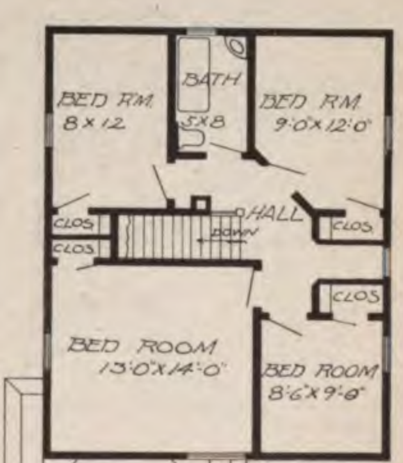
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,850.00 to about $2,000.00, according to the locality in which it is built.



Design No. 2014



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

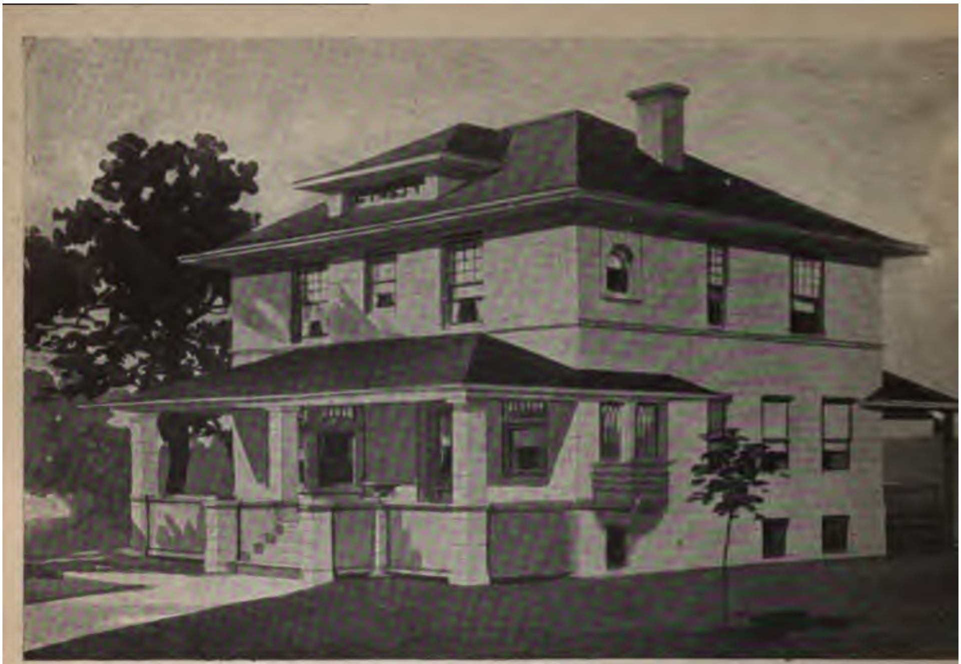
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 24 feet; length, 30 feet, exclusive of porch

Blue prints consist of basement plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,750.00 to about $1,950.00, according to the locality in which it is built.



Design No. 2034

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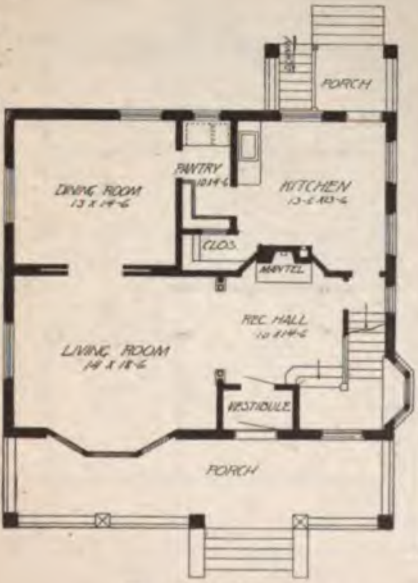
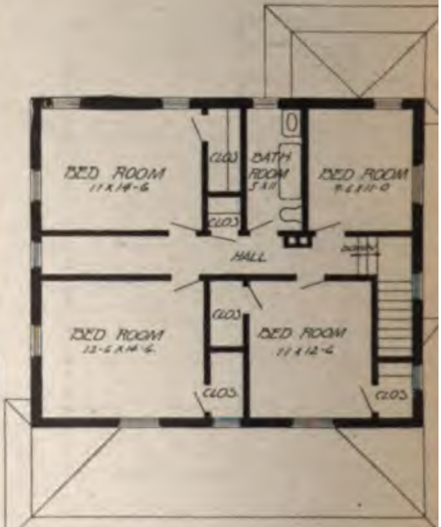


First Floor Plan

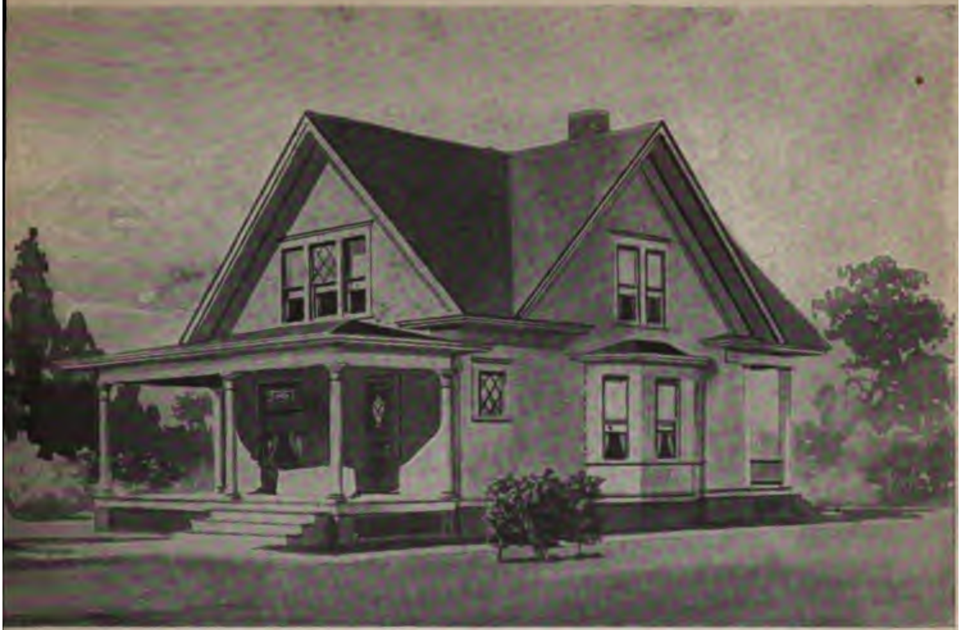


Second Floor Plan

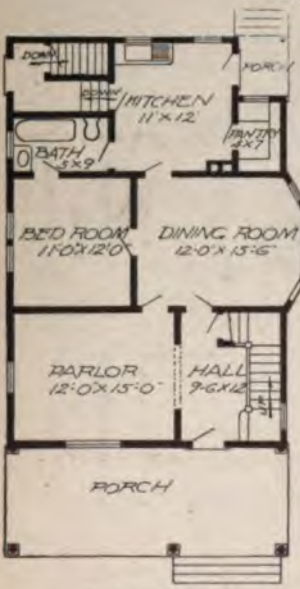
Size: Width, 35 feet; length, 31 feet, exclusive of porches

Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

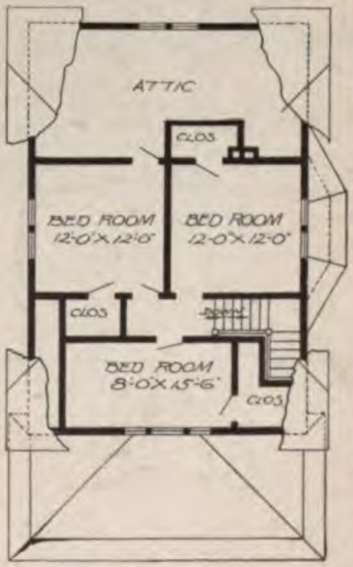
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,550.00 to about $2,800.00, according to the locality in which it is built.



Design No. 2008



First Floor Plan



Second Floor Plan

PRICE

of Blue Prints, together with a complete set of typewritten specifications is

ONLY

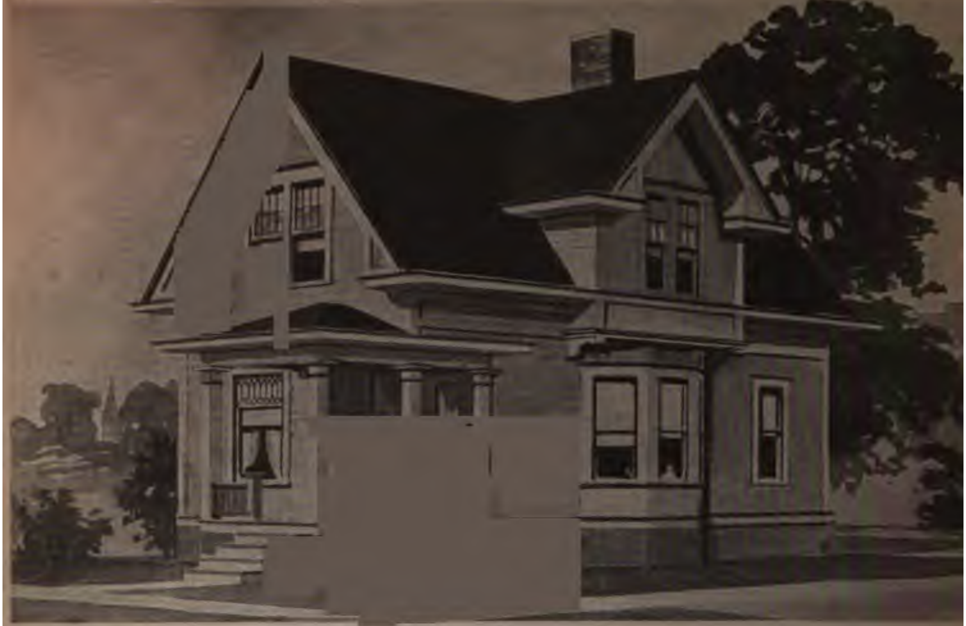
$5.00

We mail Plans and Specifications the same day order is received.

Size: Width, 28 feet; length, 38 feet, exclusive of porch

Blue prints consist of foundation plan; first and second floor plans; front, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $2,000.00 to about $2,250.00, according to the locality in which it is built.



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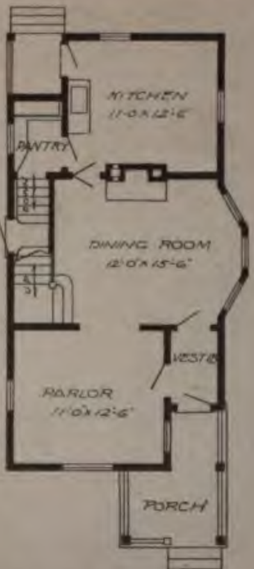
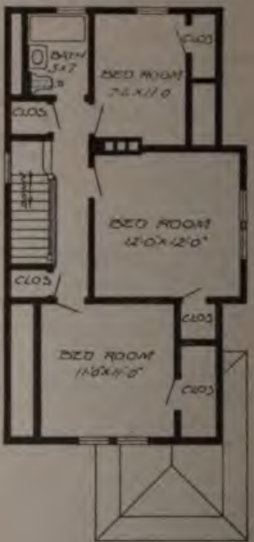


First Floor Plan



Second Floor Plan

Size: Width, 22 feet; length, 36 feet, exclusive of porch

Blue prints consist of cellar and foundation plan; first and second floor plans; front [redacted] two side elevations; wall sec- essary interior details. nsist of about twenty ten matter.

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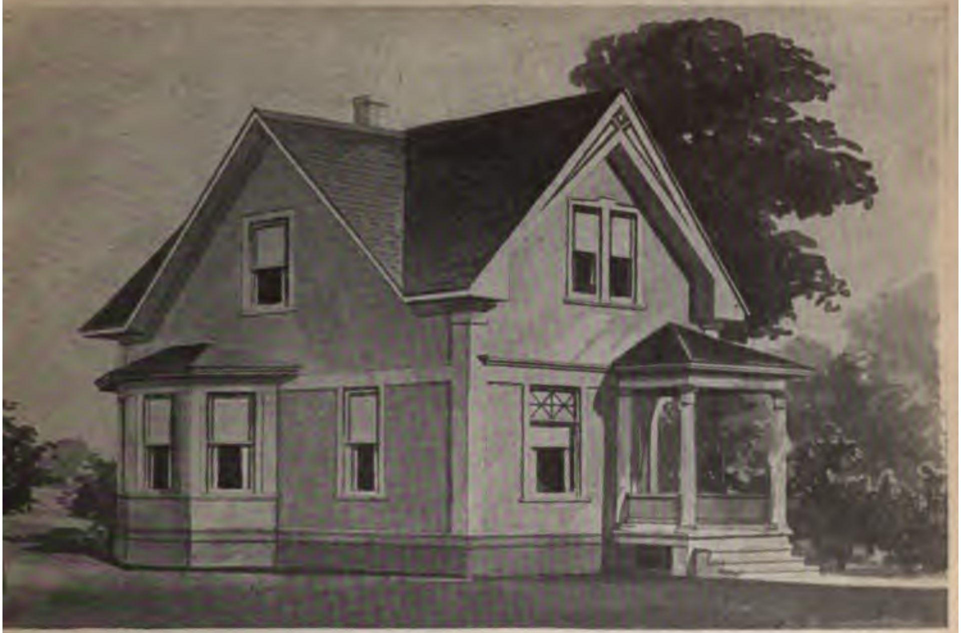

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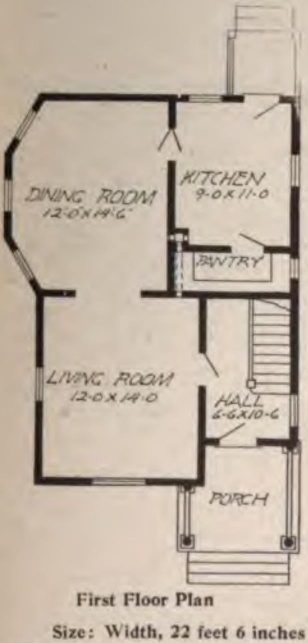
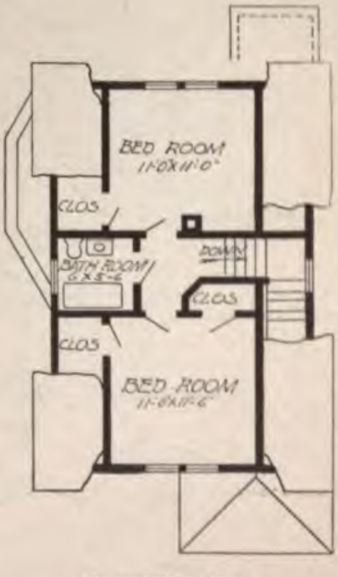


First Floor Plan



Second Floor Plan

PRICE of Blue Prints, together with a complete set of typewritten specifications is

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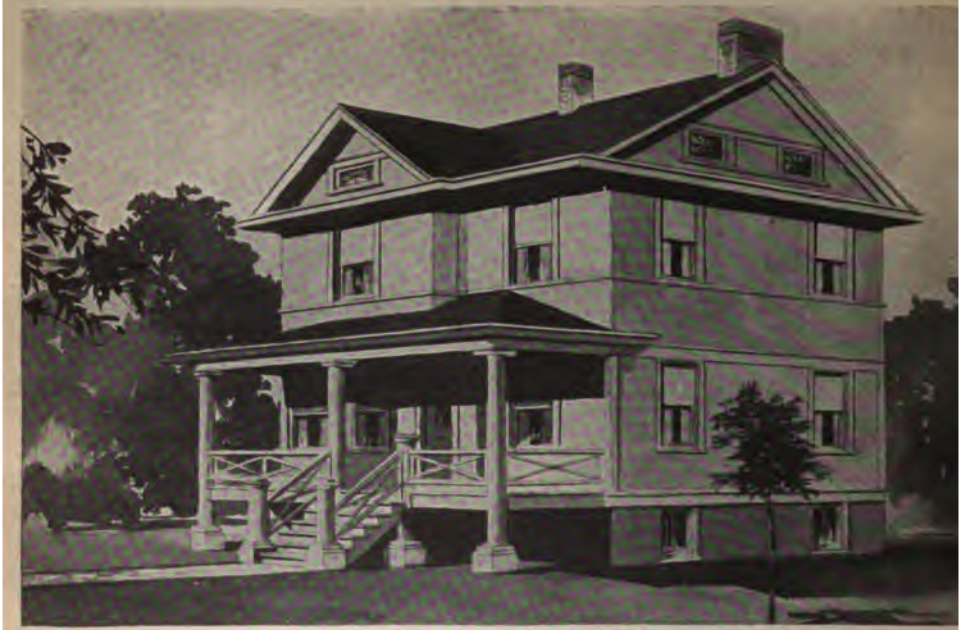
Size: Width, 22 feet 6 inches; length, 30 feet, exclusive of porches

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations, wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $950.00 to about $1,100.00, according to the locality in which it is built.



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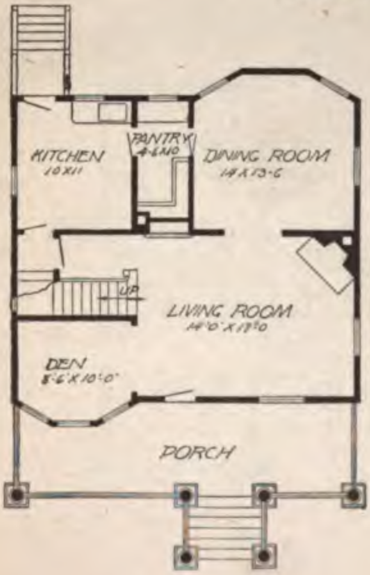
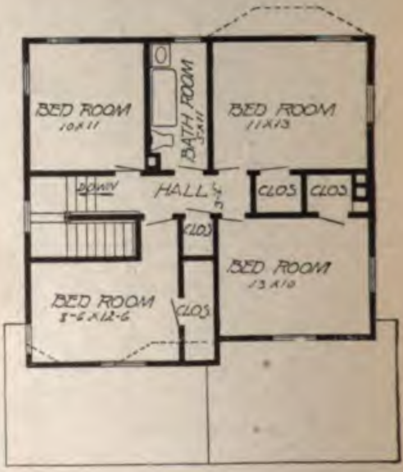


First Floor Plan

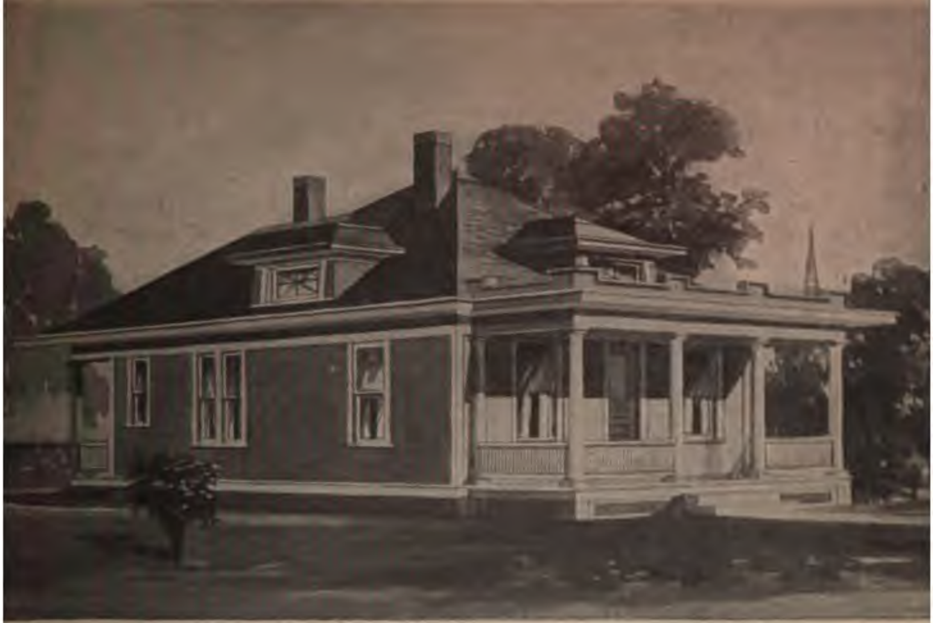


Second Floor Plan

Size: Width, 30 feet 6 inches; length, 31 feet, exclusive of porch

Blue prints consist of basement plan; roof plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,750.00 to about $1,950.00, according to the locality in which it is built.



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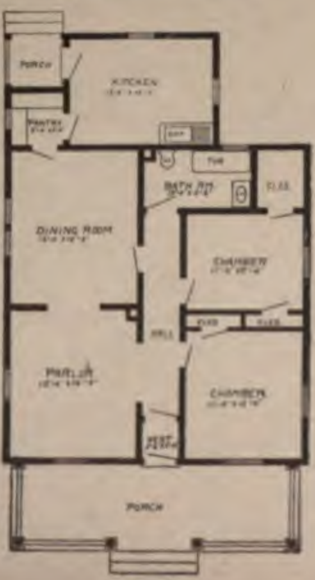

Floor Plan

PRICE

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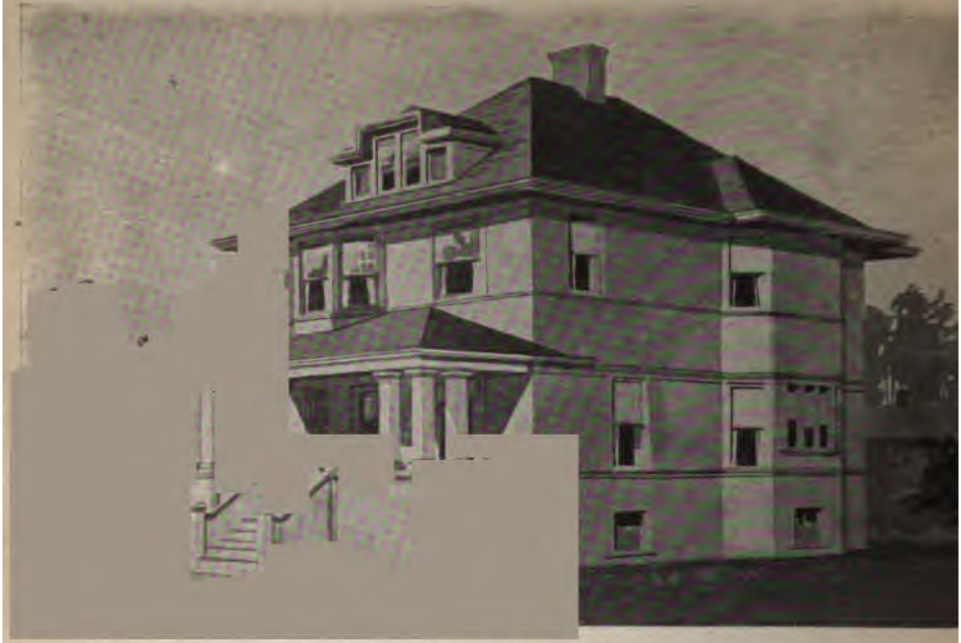
Size: Width, 28 feet 6 inches; length, 40 feet 6 inches, exclusive of porch

Blue prints consist of basement plan; roof plan; floor plan; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about fifteen pages of typewritten matter.

Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,250.00 to about $1,400.00, according to the locality in which it is [illegible]



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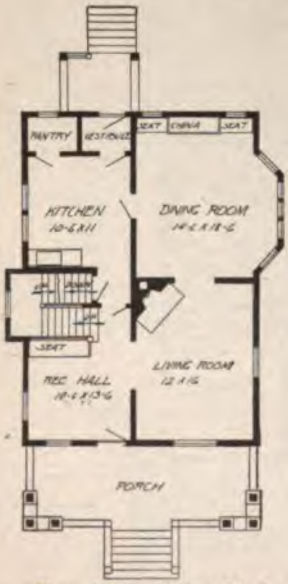

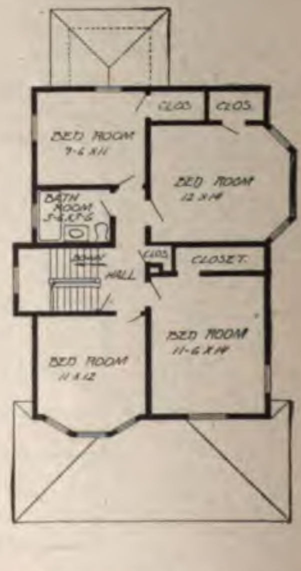

Size: Width, 28 feet 4 inches; length, 34 feet, exclusive of porches

Blue prints consist of cellar and foundation plan; roof plan; first and second floor plans; front, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

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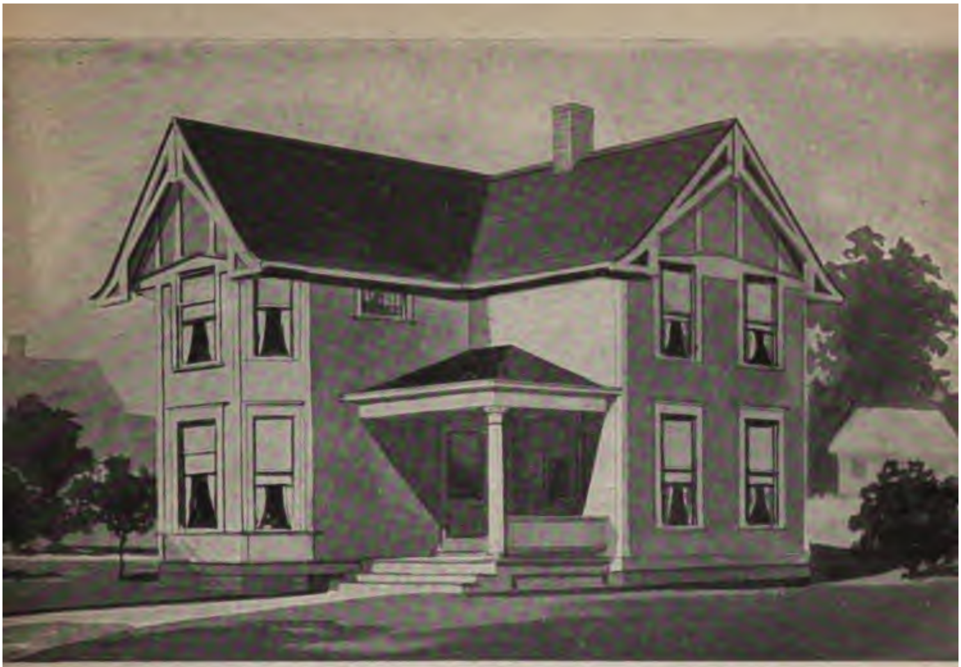

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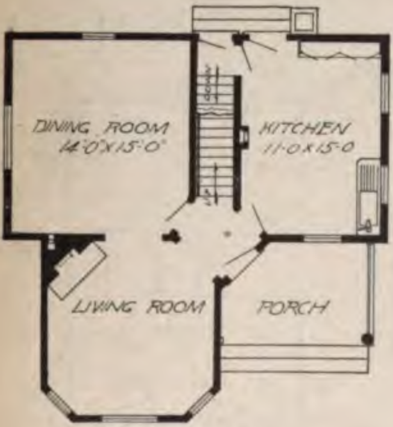
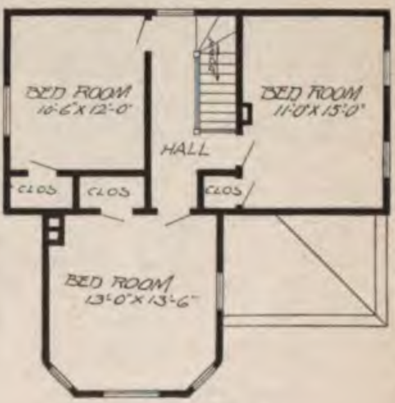


First Floor Plan



Second Floor Plan

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Size: Width, 30 feet; length, 30 feet

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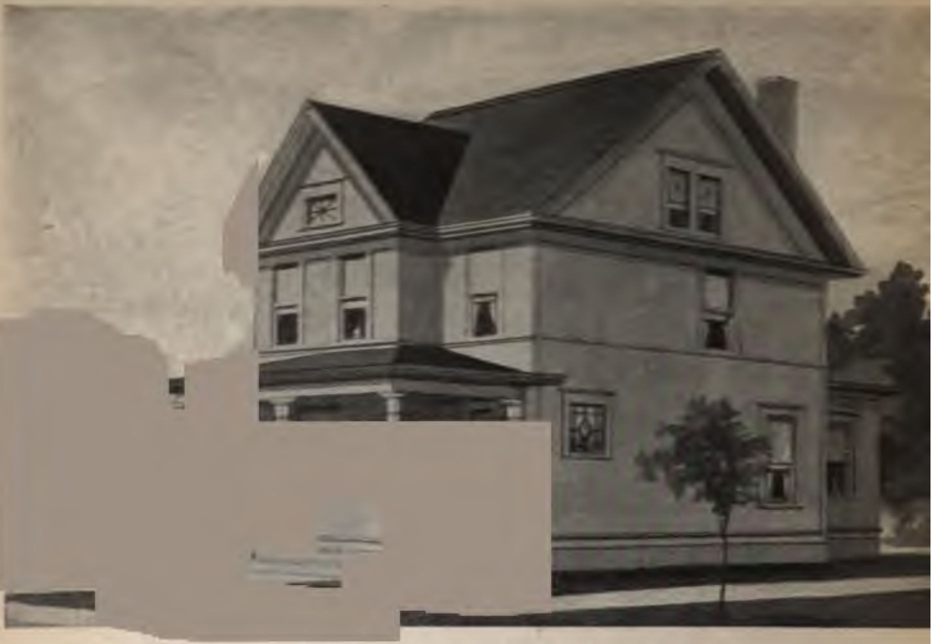
Full and complete working plans and specifications of this house will be furnished for $5.00. Cost of this house is from about $1,250.00 to about $1,400.00, according to the locality in which it is built.



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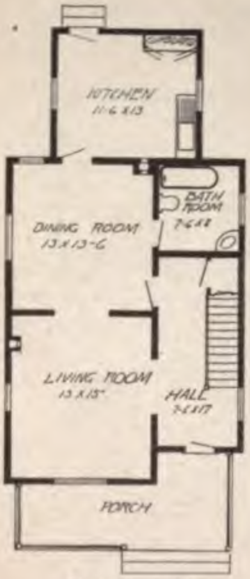
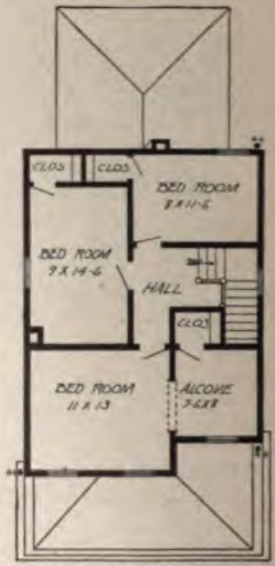


First Floor Plan



Second Floor Plan

Size: Width, 22 feet; length, 52 feet, exclusive of porch

Blue prints consist of foundation plan; first and second floor plans; front, rear, two side elevations; wall sections and all necessary interior details. Specifications consist of about twenty pages of typewritten matter.

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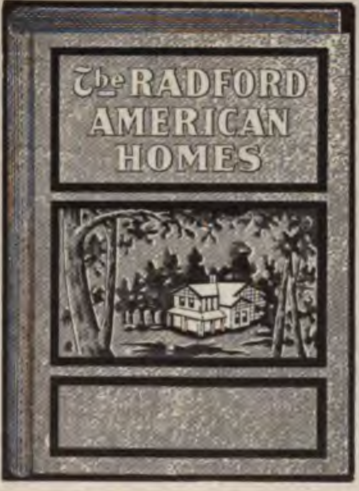

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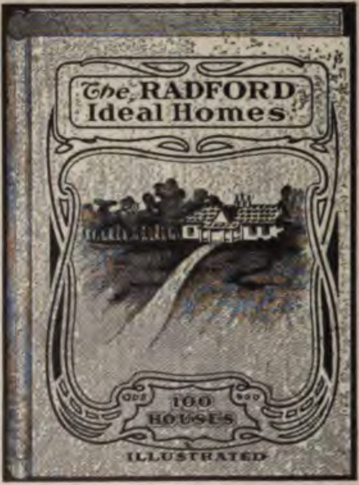

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